DOCUMENT RESUME

ED 186 028 IR 008 396

AUTHOR Hailer, Harvey A.
TITLE Uses of Individualized Instruction in Training by "High-Technology" Firms in the San Jose, California Area.
PUB DATE 30 May 79
NOTE 108p.; Master's Thesis, San Jose University.

EDRS PRICE MF01/PC05 Plus Postage.
DESCRIPTORS Computer Assisted Instruction; Computer Science; Cost Effectiveness; *Electronics Industry; *Individualized Instruction; *Industrial Training; Interviews; Literature Reviews; Questionnaires; State of the Art Reviews; *Use Studies
IDENTIFIERS *California (San Jose)

ABSTRACT

A literature review was conducted to examine the current status, advantages, and cost-effectiveness of individualized instruction in industrial training in over 30 companies and training specialists in 11 electronics and computer-related firms were interviewed to determine the current use of individualized instruction in employee training programs. Media utilization, instructional development methods, general trends, and predictions for future training methods in these companies were also examined and compared. Results indicated that in-house training is growing in importance as a result of a shortage of experienced staff; feedback, evaluation, and revision are the weakest aspects of instructional design schemes used in the electronics industry; training of manufacturing skills will increase rapidly and use individualized instruction extensively; and individualized instruction, which is cost-effective and useful in handling problems created by geographic dispersal of employees, is a medium of high potential growth for training in technical subject matter. Appendices include the interview instrument; a list of firms in the San Jose area involved in electronics, computers, and related equipment with over 500 employees; an interview with a firm's training coordinator; and a list of the firms interviewed. (CMV)

**********
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
**********

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

ED186028

# USES OF INDIVIDUALIZED INSTRUCTION IN TRAINING BY "HIGH-TECHNOLOGY" FIRMS IN THE SAN JOSE, CALIFORNIA AREA

A Research Paper

Presented to

the Faculty of the School of Education

San Jose State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

Plan B

By

Harvey A. Hailer

May 30, 1979

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Harvey Hailer

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

IR008396

TABLE OF CONTENTS


| Chapter | | Page |
|---|---|---|
| 1. | PROJECT DESCRIPTION | 1 |
| | Statement of Problem and Methodology | 3 |
| | Importance of the Project | 6 |
| | Definition of Terms | 7 |
| | Organization of the Paper | 9 |
| 2. | REVIEW OF THE LITERATURE | 11 |
| | What is Individualized Instruction? | 13 |
| | Adults and Learning | 15 |
| | In Defense of Tradition | 16 |
| | Advantages of Individualized Instructions? | 19 |
| | Uses of Media in Individualized Instruction | 22 |
| | Cost-Effectiveness | 34 |
| | Individualized Instruction in the Future | 37 |
| | Summary | 42 |
| 3. | SURVEY DESIGN AND APPROACH | 43 |
| 4. | SURVEY FINDINGS | 48 |
| | Field Engineering | 49 |
| | TABLE 1 | 50 |
| | TABLE 2 | 51 |

Chapter Page

TABLE 3 . . . . . 52

TABLE 4 . . . . . 53

TABLE 5 . . . . . 54

TABLE 6 . . . . . 55

Evaluation of Courses . . . . . 56

Individualized Programs in Field Engineering . . . . . 59

TABLE 7 . . . . . 62

Figure 1 . . . . . 62

Manufacturing Training . . . . . 63

TABLE 8 . . . . . 66

Figure 2 . . . . . 66

Corporate Training . . . . . 68

Advantages of Individualized Instruction . . . . . 72

Independent Use of Individualized Instruction . . . . . 74

Future Developments in Individualized Instruction . . . . . 75

5. SUMMARY AND OBSERVATIONS . . . . . 80

REFERENCES . . . . . 87

APPENDICES . . . . . 92

A. Survey Questionnaire . . . . . 93

B. . . . . 97

C. . . . . 98

D. . . . . 102

## Chapter 1

## PROJECT DESCRIPTION

Traditionally, instruction has been synonomous with schools. Job skills training, while important, has not been the primary goal of the public school system. Today, business and industry are getting increasingly involved in the instructional process for several reasons. As modern equipment, materials, and manufacturing techniques become more subtle and complex, workers must have training beyond common sense and related experience, in order to perform their jobs. Management, too, needs continual training to maintain or increase effectiveness. Since new jobs and job skills are developing faster than they can be considered for or incorporated into public or trade school curricula, industry has increasingly assumed responsibility of training its own workers.

The importance of training and development in private industry is becoming more widely acknowledged. Don Freeman of Insgroup, Inc., an instructional development company, believes that most corporations are just awakening to the value of training their employees. (1) Based on his own experience and that of Insgroup, he foresees a rapid growth in demand for both trainers and training programs. Many companies sense a need for train-

ing but are uncertain of what should be taught or how to develop the most effective instructional techniques for their circumstances.

Years ago, an employee new to a job could simply use the "sit by Nellie" approach. He would sit and watch the experienced worker perform the job and then imitate the expert. Today's technology does not permit such a casual approach, and a company conscious of productivity cannot afford the luxury of two workers doing one job. The goal is usually to make the new employee productive as soon as possible.

In order to increase productivity and keep employees current in their job skills, industry is getting more involved in the educational process. Some corporations, such as IBM and Xerox, have their own permanent national or regional campuses. Others are still asking outside consultants to help them define, analyze, and solve their production and management problems.

In many respects, the Army is taking a lead in progressive training techniques. The Training Extension Course (TEC) Program uses modules which are individualized, self-paced and criterion referenced and must include post-tests based on the performance objectives. Most of these lessons involve psychomotor skills, and are similar in scope to those that private industry would develop for new product orientation or new employee skills training. Since 1971, 4,916 individualized lessons in the TEC Program have

been produced at a total cost of $96.4 Million. Most important, studies show that soldiers using this format learned and retained 10% more than traditional instruction. Yet, TEC costs only 1.4% more than traditional training. (2)

The concept of training employees, in private industry, is growing as new technologies make it difficult to gain experience, except on the job. For many areas of the electronics industry, for example, even national recruiting efforts cannot find enough experienced workers.

## Statement of the Problem and Methodology

This study sought to determine the involvement of selected private industry firms in the Santa Clara Valley in training and development. Rather than attempt to survey the wide variety of media and methods used, this study will examine the status of "individualized instruction", as used by the selected firms to train their employees.

While still considered innovative, individualized instruction is well established in the public school system. Its greatest success has been at the elementary level, and its use seems to decrease as the grade level increases. This seems odd, as one assumes that as the student matures, he will be more capable of working on his own. The situation leads to speculation. Does this imply that students as adults lose their ability to succeed in an individualized learning system? Perhaps the material they are learning does not lend itself to an individualized approach.

Perhaps the daily schedule is not conducive to the individualized format. Or, perhaps, teachers at the upper levels are not trained to develop and implement individualized instruction.

By looking at the uses of individualized instruction in a number of private firms, a general status report can be developed on the usefulness of individualized instruction in industry. How is individualized instruction used? In what subject areas? Is it common or restricted in use? What is its future?

The study is limited, for convenience, to firms in the San Jose, California area. All firms are located in Santa Clara County, which includes the famous "Silicon Valley" electronics region. As this includes a wide variety of types of companies from space-age electronics to trucking companies, certain criteria were used in selecting the firms to be surveyed:

1. High technology firm, i.e., computer or electronics related.
2. At least one full-time person in a training capacity.
3. At least 500 employees.
4. Training department, headquarters located in Santa Clara County.

In the selection of firms, an effort was made to include companies producing different products, in order to get an overall impression of training requirements. However, work commitments, cooperation and scheduling constraints also influenced the final selection of firms.

Training departments chosen included primary emphasis in manufacturing skills, service skills, and sales techniques. Chapter 3 discusses the selection process, survey format, and characteristics of the firms surveyed.

The purpose of the survey was two-fold:

1. To describe the current uses of "individualized instruction" in training and development of company employees in the San Jose area.
2. To discuss the role individualized instruction might play in training and development over the next five years.

The information generated from this study is useful in several other areas, including:

1. Providing secondary schools, adult education, and higher education with specific content areas where individualized instruction has proven successful. Traditionally, higher education and high schools have lagged behind the elementary grades in the use of individualized instruction. This study suggests subject areas which a school might elect to individualize with some confidence of success. Conversely, the survey indicates areas less suitable for an individualized approach. In these areas, other methods of instruction are likely to prove more successful.

2. Providing information to SJSU IT Department on the topics and media emphasized currently in training and development programs by private industry.
3. Providing insight into educational methods used in the private sector for teachers who are anticipating a career change. Teachers will be better able to evaluate their skills for industry by recognizing the methods and skills valued by industry.

## Importance of the Project

Several studies show that in schools, students in an individualized format score at least as well on exams as those in a traditional format. (2,3,4,5) Private industry does not have the same constraints or conditions as schools. Continual positive reinforcements, through job success may make individualized instruction desireable in many circumstances.

A review of the literature indicates that the training and development picture is fragmentary. Discussions of individualized instruction (I.I) or case studies are infrequent and widely scattered. Thus, it is difficult to sense whether a case study is really typical or a unique isolated example. This survey seeks to gather many of these fragments together into a general overview of the status of individualized instruction in industry today.

The Santa Clara County business scene provides a blend of established firms such as Lockheed and IBM with younger companies such as Intel and ROLM. Thus, it is likely to provide a typical cross section of training techniques.

The study, while not exhaustive, can provide a basis for comparison by training departments with other companies. Any comparison might elicit a self-examination by a firm's training department where differences exist. No firm's training can be categorically judged the "best", but the survey results may stimulate ideas and self-appraisal. This alone makes the survey worthwhile.

## Definition of Terms

"Individualized Instruction" is a term which covers a variety of teaching methods, from written homework to computer-assisted instruction. This study uses the term to indicate a unit of material to be learned by an individual working independently in a self-paced manner. The lesson is based on performance objectives, so that individual knows what is expected of him. This is similar to what Mager (7) would call programmed learning.

Mager would also take exception to the common usage of the term "individualized instruction". He defines it in a manner similar to that used by Individually Prescribed Instruction (IPI), i.e., lessons prepared or tailored to each individual's needs and abilities. (6:24) This is

rarely done due to the time, effort and expense involved.

Mager feels it is more accurate to describe the format as "individualized learning" since each individual is controlling the rate and manner in which he learns. Such a tight definition is not used in this study. The more general, though less accurate, term "individualized instruction" is used since it creates a common mental image in most people's minds.

Other terms used in this paper which deserve accurate understanding include:

| | |
|---|---|
| Development: | "not only embraces 'training' and 'education', but also contains efforts at developing character, interpersonal skills, self-awareness, and other dimensions of personal growth and behavior." (8:31) |
| Education: | Instruction "concerned with the development of the mind, the transmission of knowledge, the ability to reason." (8:31) |
| Mastery Learning: | A way of organizing and managing instruction in which pre-specified performance criteria are achieved by each qualified learner. (7:10) |
| Objectives: | A written statement describing an intended outcome in terms of student performance. (7:11) |
| Programmed Instruction: | Instruction that proceeds according to a pre-specified pattern intended to accomplish one or more performance objectives for a specified audience. (7:11) |
| Self-paced Learning: | The pacing of learning when determined by the learner. (7:12) |

Training: Instruction designed to increase technical or manual skill development; typically vocational in nature. (8:31)
"There is a big difference between education and training. Education is the process whereby one gains many facets of information and general knowledge, and stores this information for possible future use. Training is the application of specific knowledge to specific tasks through guidance and practice." (9:3)

## Organization of the Paper

This introductory chapter has provided background information, outlined the area of inquiry, described constraints placed on the study, and indicated the intended usefulness of the material gathered.

Chapter Two provides a review of the recent literature related to individualized instruction in business and industry.

Chapter Three described the procedures used in collecting the data, describes the selection of survey questions, and firms to be surveyed.

Chapter Four contains the results of the survey in narrative, graphics, and tables. Pertinent comments of those interviewed are also included.

Chapter Five summarizes the findings of the survey and suggests related areas suitable for further inquiry.

References follow the report and are described in the text by scientific notation. Appendices follow the reference section and include the questionnaire used in the

structures interview, and a listing of firms which participated.

## Chapter 2

## REVIEW OF THE LITERATURE

A review of the literature was conducted in order to develop background material concerning the role of individualized instruction in business and industry, and to provide a basis for comparing results of the survey.

The DIALOG data base system was utilized to search the Educational Resources Information Clearinghouse (ERIC) files for related documents. The primary descriptors used were: 1. individualized instruction, 2. performance based education, 3. CRI, 4. training, 5. surveys, 6. criterion referenced instruction. Combinations of these and other descriptors were used in an effort to locate pertinent articles and documents.

The ERIC search proved to be less productive than anticipated. In the search, "individualized instruction" and "survey" were combined with "business" or "industry" or "training". This was the ideal grouping with regard to the intent of the study, yet the search yielded only four items from the over 300,000 items catalogued in ERIC. A review of the abstracts for these four items indicated that only one was indeed relevant.

A manual search through ERIC's journal and document indexes indicates that ERIC is not a useful source of

information for the topic. Not all of the major training periodicals are indexed in the abstracts.

The best known training periodicals are Training, Training and Development Digest, Training Digest, and Training Officer. Ulsrich's International Periodical Directory, 1977-78, was used to determine where these periodicals are indexed. Training Digest and Training Officer could not be found, by the researcher, indexed anywhere. Both have circulations of approximately 15,000. Training and Training and Development Journal are indexed in Work-Related Abstracts and Personnel Management Abstracts. Neither of these latter periodicals were available through the SJSU Library or the South Bay Reference Network. A search through the two abstracts did prove fruitful, however, as they include a number of European periodicals in addition to the American ones.

A review of the abstracts suggests that the U.S. is lagging behind Europe in the attention and effort given to industrial and business training. Personnel Management, a British Journal, consistently features articles on training, while American management periodicals tend to place greater emphasis on the mechanics of organization structure and management. The Journal of European Industrial Training is also indexed in Work-Related Abstracts.

Fewer references on the use of individualized instruction (I.I.) were found than anticipated. Out of curiosity, a review of one magazine was conducted to deter-

mine how much attention is given to I.I.

Ten issues of Training magazine for 1976 were surveyed for articles on I.I. The number of article titles listed in the tables of contents was 104. Of those, 5 concerned I.I., either in theory or as case studies. One other article contained a reference to an individualized program. Thus, 6 of 104 articles, or 5.76% concerned individualized instruction.

A similar review was done on the May, June, September, October 1978 and the January, February 1979 Training magazines. Of the 82 tables of contents entries in these 6 issues, 8 had content related to I.I. This constitutes 9.7% of the total articles.

This chapter is divided into the following sections:

1. The concept of individualized instruction (I.I.).
2. Examples of individualized instruction in business.
3. References to the future use of I.I.

## What is Individualized Instruction?

Chapter 1 pointed out several definitions of individualized instruction (I.I.). According to Mager's definition, very little of what is purported to be "individualized instruction" is actually individualized. The common mental image, however, is of a relaxed room with much activity and enthusiasm as students work separately on different parts of a training unit or package. Each one has an attitude of

purpose about him and is directing his efforts toward a clear goal. The trainer is ever present and busy . . . but as a facilitator and resource person . . . rather than an authoritarian figure or platform lecturer.

A British definition of these training units or individualized packages provides a similar explanation.

> It is difficult to give a precise definition of a training package; however, it may be generally described as a self-contained unit of instruction which does not require the supervision of a qualified instructor. The unit takes the trainee through a learning process and results in effective performance on completion. (10:30)

These characteristics are somewhat general and necessarily so, because there are so many variations of I.I. when one considers the "hardware" and "software" available. Individualized instruction may not be appropriate for all subjects, nor do its proponents claim it as the panacea for all education. But when certain conditions do exist, individualized instruction is indeed the most logical method to use in training.

A comparison of traditional and current military training illustrates the basic characteristics of criterion-referenced individualized instruction:

| | Traditional | Performance-oriented |
|---|---|---|
| 1. | Lecture delivery "Pointer-podium-po op" | Emphasized student practice |
| 2. | Emphasizes knowledge of subject matter | Emphasized practicing a specific task |
| 3. | Evaluation is by checking | Evaluation is by observing |

the time spent in training and by evaluating the instructor's delivery. the student's performance after training. (14-24)

## Adults and Learning

Adult learners tend to have a clearer purpose in learning and anticipate a use for their new knowledge or skills than do most high school or college students. From career changes to do-it-yourself projects, adults continue to learn outside the formal classroom.

In a review of adult learning, Allen Tough, Professor of Adult Education at the Ontario Institute for Studies in Education, concluded that

> Probably 90% of all adults engage in at least one major learning a year. A learning effort is at least 100 hours of study directed at one topic. Only 20% of these projects are planned by a professional, the rest are self, friend, or peer oriented.
> The most common motivation for learning projects is some anticipated use or application. (12:8-10)

This indicates that adults are capable of self-learning, especially when there is a reward for learning.

Malcolm Knowles has found learning contracts to be a useful aid for adults engaged in a learning activity.

> The first principle of a learning contract is: they are a vehicle to move the learner from where he is to where he wants to be. The only real motivation for learning is the learner's desire to develop some competency. And the best basis for the development of a learning contract is a competency model. (13-57)

Knowles has found the learning contract appropriate to short term goals, long term goals, and even management

development for individuals.

A learning contract has four specifics:

1. Learning objectives.
2. Resources and strategies to accomplish each objective.
3. Evidence to be collected of having accomplished each objective.
4. Criterion means that will be used by, say, peers for getting that evidence validated. (13-57)

The contract is basically a different view of the principle of individualized instruction.

Military training has evolved from the traditional lecture to the individualized format because it is clear and measurable. The lecture method became entrenched in WWII due to lack of time, need to standardize information, and an effort to standardize sequence of teaching and time allocated. This approach was reversed in 1971 by General William C. Westmoreland. Performance objectives as the basis for training are spreading throughout the military services. "The important thing about performance training is not that it is new, but that it is effective." (14:30)

## In Defense of Tradition

The literature search was limited to a search for only references to individualized instruction, since that is the topic of the survey. This is not to imply that all training and development exists in an individualized format. With the number of educational "experts", types of material to be learned, and variety of learners, no single system

can apply to all situations.

Not all students or employees know how to learn on their own. Some prefer the traditional systems and have better success there, because it is familiar to them. Some will succeed (or fail) in spite of the system, to use an old cliche.

> As it turns out, good readers would probably do better than poor readers, no matter what the method of instruction used. The same can be said of students of high mental ability. (15:23)

Chapter 1 pointed out the variety of definitions describing "individualized instruction". The state of the art is not truly individualized according to a study of the needs, motivations, abilities of each student. Consideration of time, expense, and cost-benefit will prevent it from being other than a rare occurence.

In this article, "It's time to jump off the individualized instruction bandwagon", Beaulieu says:

> Finally, the idea that individualized instruction is individual is out of focus. To be sure, individuals study these programs independently at their own pace, retrieving and reassessing information as material is assimilated . . . Independent study, yes. Self-paced, yes. Individualized, no. (15:23)

A glance at any book on instructional design and the use of measurable objectives shows the emphasis to be in the cognitive and psychomotor domains. The affective domain remains neglected becuase it is difficult to measure or quantitatively measure such things as attitudes and values. In this area other types of instruction may be superior.

Classroom or group learning can "change the

attitudes, skills, perceptions, motivation, commitment, and desire for excellence of the people who populate the place." (16-41)

> Any classroom situation that brings people together can help create a solid managerial community . . . and all our evidence is that relationships developed in the classroom carry over to the job environment. Not only do the personal relations improve, so does the ability to work together cooperatively. (16-40)

And as a last word not to put all your eggs in one basket:

> We never did learn. We haven't learned about television . . . programmed instruction . . . computer assisted instruction . . . Each failed to reach the level of impact envisioned by its supporters.
>
> The reasons for these failures are many, but the major ones are consistent: overselling, unattainable promises, poor quality in the associated software, little evaluation, and, most significantly, each was introduced without the planning necessary for wise use and quality instruction. (17:54)

Although touted as a versatile tool, individualized instruction is not a rubber stamp approach for all subject matter. There are some situations which demand group interactions, such as role-playing, simulations, or case studies. Even some old-fashioned lecture-discussion may be infinitely better than individualized study in some cases. (15:23)

> It should be emphasized that the audio-visual program will supplement, not replace the teacher-pupil method of training. The audio-visual approach is the new and better way of doing things, but the personal element is still important. The trainer who introduces the new employee to the training machine must create a positive learning atmosphere by helping the newcomer to feel comfortable with the machine. (22:29)

## Advantages of Individualized Instructions?

The old adage "Money talks" holds true for training within corporations. Companies indicate a willingness to spend money for training as long as there is a problem which can be solved by a training effort. The cost-effectiveness of individualized programs can be readily documented, as is discussed in the next section.

Due to factors which include geographic decentralization, skill levels required and economic pressures, many companies are moving toward standardization of procedures and manufacturing techniques in order to control costs. When standardization of training for many employees is possible, individualized instruction is a suitable delivery format.

> Briefly then, the challenge facing trainers . . . today may be summarized as
>
> - Coping with an increased number of trainees with frequently changing needs, whilst avoiding an escalation of training costs.
> - Maintaining cost-effective training and dealing with a greater geographic spread of trainees resulting from the process of decentralization.
> - Ensuring resources and methods are employed which achieve the desired results both quickly and economically. (10:30)

For example, Honeywell Information systems trained more than 40,000 customers and internal personnel in 1975.

> A study done in 1969 revealed that over 50% of the teaching for all Honeywell instructors was devoted to a dozen basic entry-level courses. The study concluded that, since the demand for

> these courses was so high and their content was relatively stable, they should be packaged in some suitable format. (18:39)

Individualized instruction was the format adopted by Honeywell.

Another familiar group, the U.S. Army, is one of the strongest proponents of individualized instruction. Most Army training is job or skill related, and with the large numbers of soldiers needing training, an individualized approach is most appropriate.

The Army's "Project Utrain" which trains trainers, emphasizes the following principles of performance:

- Present only necessary information when students need it to perform the task.
- Require students to begin performing the task immediately.
- Allow students to develop mastery at their own pace.
- Aid students' learning by coaching.
- Establish quality control by administering performance test. (14:27-28)

Robert Weisgerber of American Institute for Research provides a lengthy and useful description of the conditions necessary for individualized instruction. (19:5)

Most individualized programs are based on objectives or desired course outcomes. This criterion-referenced instruction has

> a reverse approach to training. Traditionally, the cost per student and the amount of learning time are fixed, but competence . . . varies widely at the end of the course. With CRI some graduates take longer but all are equally competent. (21)

Thus, individualized instruction is appropriate when a trainer is faced with:

- a large number of students
- vocational (or mostly psychomotor) skills are to be taught
- information can be standardized for application throughout the company
- competency is valued more than length of training session
- workers are geographically dispersed
- competency is needed.

Individualized instruction is an accepted form of instruction because it works. It's a simple but accurate answer, and for some types of material, individualized instruction is a better approach than any other instructional format.

What does "better" mean? Many descriptors could be appropriate and impressive. But the trainer remains an important factor in the success of an individualized program. His orientation of the student will enhance the student's success and motivation.

The Army's Training Extension Course (TEC) program was begun in 1971 and has been subjected to much research. Through the end of fiscal 1979, 4916 different lessons have been developed at a cost of $96.4 Million. Each TEC lesson is self-paced, consisting of an audio cassette and a Super-8 cartridge film used in a Beseler Cue/See format. Studies show that TEC students initially learn 10 per cent more and

still retain 10 per cent more at the end of 32 weeks, when compared to conventional instruction. (2:6, 12)

## Uses of Media in Individualized Instruction

It is likely that the more publicized programs in training reflect the typical situation. In a business setting, costs and labor need to be justified and a training investment probably must demonstrate merit before it is adopted. Thus, the literature review did not seek to be exhaustive, but rather focused on recent events in training, going back to approximately 1976.

Ten media or media combinations used in corporate training are described. No one medium can be judged "better" than any other because each is considered to be working well in its particular set of circumstances. A list of variables considered in selection of a hardware package would serve little purpose here and is available in published works. Rather, it is more useful to examine the medium in relation to the company's goals and circumstances. The general flow of ten descriptions are from the more simple toward the more complex equipment.

### Programmed Instruction

Individualized instruction suffers from a maligned view in many areas due to the tedious simplistic approach of linear programming so widespread in the 1960's. Hundreds of companies sprang up selling essentially "counterfeit" programming. Good programming takes about 100 hours of

preparation time and validation for each hour of instruction. (23:29-31)

Straight linear programming tends to be monotonous and costly, and branching systems are equally expensive. Use of programming principles in a related format is a more common application of programmed instruction. The Bank of America, for example, uses a workbook approach to train tellers in new customer programs offered by the bank. Chunks of information are provided in a linear sequence with occasional review questions and directions for review study. A self-administered test completes the package.

Audio Tapes

Several corporations have found audio tape to be useful in employee training, due in part to the necessity of commuting to and from work, and the widespread popularity of car stereo systems. Tapes are convenient to listen to and easy to use for review as needed.

> The number of off-the-shelf programs commercially available to build a cassette tape library has more than tripled in the last decade, thanks in part to the increased popularity of the car cassette system. (24:26)

An important advantage to the use of cassette tapes is that lost or nonproductive time can easily be channeled into learning time. The commute problem is a good example of how, otherwise, lost time can be better put to use. Amway Corporation provides tapes for motivation and instruction in sales techniques.

In the Health Care Division of Johnson and Johnson,

sales managers average four hours per day driving, when business and commute trips are considered. To make better use of that time, a library of cassette tapes was made available. The tapes are rented at $1.25 per week per tape and 800 are maintained in the collection. Sales managers average using four tapes per month. During the period of June 1977 to June 1978, 163 of the 220 eligible salespeople have used the program, averaging one tape per month. (25:28)

At Grand Trunk Western Railroad in Detroit, cassette players were installed in the cars for the sales representatives. Any employee can borrow the tapes as well as a recorder. Tapes are evailable for purchase at cost, should an employee so desire. (24:27)

The University of Wisconsin Extension has seven audio tape courses available in its continuing education program in pharmacy. The program satisfies the requirements of 12 states for continuing education, and more than 2,000 pharmacists were enrolled in 1972. Each lesson contains seven to eight lectures and a printed guide which has diagrams, tables, outline and suggested reading. A final exam concludes the lesson. Walgreen Drug has implemented the program throughout its chain of stores. (11:3)

The Civil Service Commission in Seattle uses Programmed Audio Cassette Training (PACT) in training up to 15,000 federal employees annually. The learner uses a programmed workbook in conjunction with a cassette player.

Student completion rate for the courses is 85%, and development costs are low. Several hundred employees use each course.

The financial benefit of the PACT Program is evident. One PACT course priced out at $15 per student. Estimated in-house development costs of the same course in a group format with the same effectiveness were $90 per participant. An outside corporation putting on an in-house course covering the same information would have cost roughly $200 per participant. (26:44-50) If the course deals with relatively standard material and is designed for a large audience, then a programmed instruction approach may be appropriate.

> The American Chemical Society has produced more than 30 audiocassette courses that have been used by over 30,000 people in the United States and abroad.
> The American Management Association has recently announced an audiocassette-based guide for executive secretaries and administrative assistants. (27:14)

Microforms

Microforms represent the entire range of micro materials, including microfiche, microfilm, and microcards. Use of microfiche in training is increasing for several reasons: convenience, low handling and shipping costs, easy storage, and increasingly simple viewing hardware. They can be considered as alternatives to slides or filmstrips.

The American College of Physicians and Surgeons is currently using color microfiche in its continuing education program.

Cost of producing a color master is approximately $100.00 and duplicates run a little more than $1.50 each. The advantage of color for accurate reproduction of visuals is very affordable in microfiche. For standard print material, black and white duplicates are as little as 12 cents each in quantity.

A program requiring 80 frames of information can be put on a master microfiche for $160 and 500 duplicates produced for $1.00 each, or a total cost of $660 for 500 sets. To do the same program in slide format would run about $8,000 for the 500 sets. The financial advantage is clear, and now that hand-held ambient light readers are available, the ease of handling adds to the advantages. (28:30-35)

Films

A midwest franchise corporation, Burger Queen, has reduced new employee training time by one-half through use of Super-8 sound films at its fifty outlets. The instructional program consists of ten films and related written materials. Each film illustrates a specific job, followed by a written test, then hands-on practice, followed by a review of the film. Super-8 was seen as the best medium because it provides essential motion and color at a minimal cost. (29:10)

No other examples were found concerning the use of Super-8 or 16mm film as the primary medium used in training. This was surprising, considering the widespread use of motion pictures in schools and for public relations by corporations.

Sound On Slide

The 3M Company has redesigned the slide/tape combination into its Sound-On-Slide system. Each slide has a magnetic strip of audio tape on it which holds 30 seconds of narration. Thus, sound and image are always in synch.

The Federal Reserve Bank in Philadelphia uses the system because it is easily revised or updated. Only one slide, not an entire cassette, needs to be revised to accommodate a changed situation. (22:30)

At Coors Container, the training support department has produced over 60 Sound-On-Slide programs, usually 20-25 slides in length. The presentations cover such subjects as can defects, quality control, tool room, and electrical maintenance. Experienced employees are used to help plan and develop training programs in areas related to their job skills. Their input is clearly valuable since purchases of the programs by other companies have paid for nearly half of the programs' development and production costs. (30:26-27)

The U.S. Army Transportation School at Ft. Eustis, Virginia, uses Sound-On-Slide as the support medium for its Chinook Helicopter Repair courses. They "reduced training time by 10% while turning out better qualified graduates." One course "was cut from 66 to 59 days and one on the Cobra Attack Helicopter went from 58 days down to 51." 1576 soldiers went through the courses in one year. (31:40-43)

Cue/See

With the shift in military training from group to individual instruction, the ARMY has chosen the Beseler Cue/See format as the hardware system for its Training Extension Courses (TEC). The Cue/See is a super 8 loop with a standard audio tape in a separate cassette.

In accordance with military specifications, lessons undergo substantial testing and revision before they are approved.

> Analyzing the statistics, TEC has been measured to be 30 per cent more effective than conventional training. And its costs are 16 per cent less, due to reductions in instructor preparation and presentation time. In addition, TEC was found to be more effective than the conventional method in teaching soldiers with lower learning capacity levels (GT scores) as well as equally effective with average or high-learning capacity levels. (32:3)

More than 22,000 Cue/See projectors are now in use by the Army.

Vornado Corporation also uses the Cue/See format for training in its 140 retail stores, "and was triggered in part by a decision to combat the high turnover rate prevalent in retail operations." Locally, Builder's Emporium is part of this corporation. (33:2)

A very similar medium, that of 16mm sound filmstrips, has been used by McDonald's hamburgers. More than 36 job skills are described in the filmstrip format, which was chosen because it is much more indestructible than film or slides. To encourage use of these training aids, franchises can purchase the projectors at cost. (34:36-37)

Video

With the strong influence of video on American society, it is little wonder that video is also strong in corporate training.

Texas Instruments, for example, produces 200 programs each year for its 40,000 employees. T.I. "employs every medium available but the emphasis is on video-cassettes, and individual self-paced modules." There are two main reasons for the video emphasis:

> . . . . in most cases, learning time can be reduced to 1/4 of that needed for live training sessions, with the same or better retention.
> . . . the cost of producing and distributing videocassettes is between 1/3 and 1/2 that of a 16mm film of the same quality. (20:54-56)

In late 1972, Lincoln-Mercury replaced its films, filmstrips, and other media with videocassette training programs. Costs of the "Dealership Video Network" are shared by the Lincoln-Mercury Division and the more than 5,000 dealerships.

Video is being used in 5 areas by the automobile group:

1. Management communications - progress reports, meetings, announcements.
2. Product presentation programs - product information and comparison to competitors.
3. Sales techniques training - 20-30 minutes each.
4. Customer merchandising presentations - 5 to 10 minutes each.
5. Mechanic Product training. (35:41)

Holiday Inns made a commitment to video in 1976 when it bought 700 cassette players. That year it had 24 hours of video programming in its library, along with printed guidebooks for supervisors and employees. In addition to training, the system is used to explain marketing strategies to management. (20:54-56)

The May 1979 issue of Audiovidual Instruction cites 21 other examples of video used in adult education. (27:12-14)

Videodisc

Since the two major developers of videodisc are developing separate and incompatible systems, there is a reluctance to become financially involved in a system which may become obsolete if the competition dominates the market. It is a wait-and-see attitude on the part of business. Despite all the excitement about videodisc, no examples of v-disc use were found.

Magnavox, developed by MCA and Philips, features "stop-frame, rapid-scan, random access to any coded frame, stereo and hi-fi sound through any home stereo unit, and touch-free 'reading' from the v-disc surface." Images are read by a laser beam. (36:14)

"(The RCA system) turntable spins at 450 rpm and readout is by diamond-pointed pickup with mechanical contact in the v-disc groove - the so-called 'Capacitance' system." (36:14)

A clear advantage of videodisc is cost of the disc,

which is only $2.00 in quantity with the lesson or program on it. A blank videocassette runs in the $15-20 range. Storage, durability, handling convenience make the videodisc attractive.

> It is intriguing that in describing videodisc, the Army uses the Magnavox videodisc characteristics as its definition. It is described as a possible replacement for 16mm films, 3/4 inch videotape, and sound filmstrips, including the Beseler Cue/See. If the Army were to replace its 12,000+ Cue/See projectors with Magnavox videodisc, it could have noticeable effect on the future market. (37)

Multi-Media

In some cases, one medium simply won't fulfill all criteria for presentation of a company's training program. Rather than attempting to manipulate a lesson to fit a particular medium, it is better to select the medium most appropriate for the content, target audience, and learning situation.

For example, the Alyeska Pipeline Service Company needs technical and survival training for its employees located the entire length of the 800 mile pipeline. Videocassettes are most appropriate for some lessons while sound/slide is best for others. Each pumping station is equipped with a Bell and Howell Ringmaster slide/sound system, to allow training as time permits. (38:55-56)

Ease of revising a lesson is a consideration in selecting the equipment. With video, a revision or updating involves significant time, technology, and cost. Sound/slide is far less sophisticated and more suitable for topics with

which periodic revisions can be expected.

In an insurance company's training program, no single format was adequate. Part of the concern was reaching the 150 new employees in 137 locations. The resulting package includes: "more than 13 modules, 3 books, 2 audio-cassettes and several performance aids." The units can be done sequentially or separately as need dictates. Also involved is much observation and feedback by the trainer, since the course involves customer contact. (39:52)

Weisgerber found a multi-media approach best in developing a course for COBOL computer programmers. Videotape and movies were eliminated as possibilities because no motion was needed. Written programming didn't provide enough motivation. As a result, programmed tests combined with color filmstrips and cassette tapes, plus standup flip charts, were used.

In a comparison, "the AV group completed the course in 5 to 8 days. None of the members of the reading (control) groups completed the course before the eighth day." This represents a reduction of training time by 20% by the use of media. Also, the AV group scored slightly higher. (19:38-54)

Simulators

In an article in Training, Judson Smith concisely explains the characteristics and value of simulators. Simulators approximate real life situations, and can be active or passive. A model, in comparison, approximates

some object, usually reduced in scale. A mock-up is often a same-size or larger device used to illustrate basic concepts by approximating the real thing. The airlines are among the largest users of simulators because they significantly reduce the cost of flight training. A simulator flight training session runs about $400 per hour while actual flight training for pilots runs about $4,000 per hour. (40:63-69)

Other simulator uses include operation of electric and nuclear power plants. Also, "it's fairly easy to understand why the U.S. Maritime Administration uses CAORF (Computer Aided Operations Research Facility) to simulate on a computer the conditions a tanker captain will face entering New York harbor. (40:67)

Coupled to a computer, the simulator also monitors a student's progress automatically, supplying information to the trainer.

Singer Link, McDonnel Douglas, and Boeing control approximately 56% of the military simulator market, which was estimated at $546 million for 1978. (41)

In 1975, United Airline pilots logged 40,000 hours on the airline's 13 simulators. "A DC-10 simulator costs $4 million, only 15 per cent of the cost of the actual aircraft." "Their (pilots') salaries and travel expenses, plus the training center staff and operation exceeded $21 million . . . " (42:11)

## Cost-Effectiveness

In the development and implementation of any instructional program, one of the factors which must be considered is cost. The employee must be paid while participating in the training program, making the length of the training period a consideration. The employee's productivity is also lost during the training period, adding to the total cost. Often there are travel expenses also, and facilities must be provided. These costs are in addition to the actual cost of the program materials and trainer.

Therefore, management expects to benefit in areas of employee effectiveness and productivity as a result of the training. A number of advantages to individualized instruction can be cited to justify the initial investment, which often exceeds that of traditional training preparation costs: In most cases:

1. Individualized instruction has no student travel or lodging.
2. Reproduction of materials decreases as the number of students increases. Costs decrease with an increase in usage.
3. Standardization - the course content is always uniform. All employees get the same training.
4. The high access to information allows flexible scheduling and review as desired.
5. Training time is nearly always reduced.
6. The system is portable. (23:31)

The Lincoln-Mercury Division of the Ford Motor

Company has conducted numerous studies on the effectiveness of its videocassette network.

> Extensive research shows a direct correlation with increased new-car sales, correspondingly greater interest, use and degree of sophistication on the part of sales personnel, extensive use with sales prospects, excellent receptance, and "internalizing" by the prospects, and extensive enthusiasm on the part of management and dealers. In other words, the dealers get significantly better results from video programming than from any previously used communications medium. (35:40)

> One study revealed that high users (among the salesmen) of video sold on an average of 20 more cars per year, or $2,000 in income ($100 per unit) than did low users. (35:43)

Certainly large organizations with many employees in various locations can expect to benefit from individualized instruction, especially in areas where the subject matter is standardized for the entire corporate operation. In some cases costs of extremely expensive realistic training can be reduced through use of simulators.

American Airlines flight training department uses 56 slide-tape presentations in its Audio Visual Tutorial program for crew members. With the program classroom time has been cut by one third and $800,000 has been saved in crew salaries, travel and incidental expenses. (43:11)

United Airlines uses a simulator to teach pilots about a new DC-10 Flight Guidance System, at a savings of $1,200 per hour over the alternative in-flight training. (43:11)

In a speech to the 1977 ASTD national convention, Robert Mager cited a number of examples of savings due to

individualized instruction.

Continental Telephone Company has converted a course on distribution of telephone apparatus to a criterion-referenced format. The first 400 students to complete the course required 5½ hours on an average. The former classroom presentation took 12 hours, indicating a 54% saving in instructional time with the CRI approach. (44:14)

Using a self-paced approach, the Army has cut training costs 15% in its course on repair of the IBM typewriter. Approximately 1000 soldiers complete this course each year. (44:14)

The Air Force has converted 52% of its 2,343 courses to an individualized format, and by doing so, has cut the number of instructional hours by 10 to 25 per cent. "Had they not given these courses the ISD (Instructional Systems Design) treatment, they would need 4,000 more personnel to accomplish the same amount of training." (44:15)

Much of the cost reduction can be attributed to the preparation of the course material prior to its administration. Use of objectives defines the intended course outcomes for both management and students. Often much extraneous though interesting material is eliminated when a performance or task analysis is conducted in conjunction with the course development.

One of the most interesting and best-documented examples of the application of recent instructional know-how comes from AT & T.

Their course for Long Lines Craftsmen was

> originally 45 days long. When a task analysis was finally carried out, it was found that a full 25 days of that course consisted of irrelevant content and could be eliminated . . . dropping the course to 20 days.

Converting the course to a criterion-referenced format reduced it to a total of nine days. "The cost to develop this new course was $350,000. But AT & T reports that between 1968 and 1973 there was a savings of $37,800,000 from this one course alone." (44:16)

Certainly the nation's largest corporations provide the most impressive statistics. But the point should be clear - individualized instruction is growing in popularity because it has proven to be effective for many types of learning. Other types of learning activity are also growing, such as role-playing, because they are effective for a particular type of learning.

## Individualized Instruction in the Future

Whenever the future of any topic or state of affairs is considered, the analyses and predictions of Alvin Toffler's Future Shock are frequently cited. Certainly the concept of time and how time is used and organized is a thread running through most considerations of the future. Since individualized learning looks at time differently than does traditional instruction, perhaps there is a continuing place for individualized instruction in the future.

> The most criticized features of education today - regimentation, the lack of individualization, the rigid

> systems of seating, grouping, grading and marking, the authoritarian role of the teacher - are precisely those that made mass public education so effective an instrument of adaptation for its place and time. (45:344)

More and more there are experiments which seek to break away from this traditional school structure - alternative schools, the open classroom, Postlethwaite, Keller's plan, for example - all are attempts to find a system which more appropriately fits today's social conditions. In most cases, this means attending to the needs of students as individuals.

As Toffler and others have pointed out, the concept of education as a permanent collection of facts is obsolete.

> The rapid obsolescence of knowledge and the extension of life-span make it clear that the skills learned in youth are unlikely to remain relevant by the time old age arrives. Super-industrial education must therefore make provision for life-long education on a plug-in/plug-out basis. (45:350)

An individualized approach to many aspects of operations in business and industry fits this last provision well.

The literature suggests that the role of training and development is expanding. New topics are being added to the training provided for employees. Subjects which were once considered part of the employees' private life, such as alcoholism and stress, are becoming a standard part of training programs.

Malcolm Knowles calls upon trainers to move toward self-directed learning. To do so, trainers should:

1. Reconceptualize their role to one of facilitator and resource for self-directed learners.

2. Learn how to help our trainees quickly learn the skills of self-directed learning.

3. Provide a much more diversified and flexible delivery system in our training program.

4. Managers and supervisors are becoming more concerned with the development of their workers, not just the control of them. (46:12-14)

Hardware costs (of computers) are being quickly and significantly reduced by the development of microprocessors. (47)

> During the past ten years, the majority of instructional computing has been done using large time-sharing systems either via telephone lines of hard-wired (terminals directly connected to the computer) with some use of microcomputers. In the last two years with the advent of the microcomputer, prices have dropped dramatically and the power has increased. (48:35)

One concern is the cost of hardware, software, and facilities associated with individualized programs. Facilities typically require special furniture, sound control, and electrical wiring. As major corporations investigate the individualized approach and find it successful, other firms will be able to study the results, anticipate similar success, and justify the larger initial expense by pointing to the long-term savings.

At Fuji-Xerox in Japan, "Mr. Komatsu (manager of service education) estimates that the investment in ten TCL (Trainee-Centered Learning) study Carrels will yield

at least a $69,000 saving in avoided costs and increased productivity by the end of 1978 and even greater savings in 1979." (49:62)

Breakthroughs in the electronics industry are occurring on a weekly basis, it appears. Certainly the electronic consumer entertainment products, such as Pong, build public acceptance of "computers" and pave the way for applications to instruction at home.

The two hardware items with the greatest potential instruction application are computer-assisted instruction and the videodisc. Excitement over CAI and programmed instruction in the 1960's was short-lived due to the high cost of software development. Estimates of 100 hours of preparation time for each hour of instruction are common. (6:29) The current excitement over videodisc does hold a tremendous potential for individualized instruction. Whether it is a fad for well-to-do consumers or a permanent addition to the media field remains unclear.

> Sixteen millimeter and the video cassette are going to be around for a long time. I remember the EVR fiasco. During that hullaballoo, I said that in five years no one would know what you were talking about if you mentioned EVR. I was right. I feel the same way about videodisc. (50:38)

This seems to represent the minority viewpoint at present. In most articles the superlatives abound when the videodisc is described. Certainly two major corporations are gambling on its success.

> Educational use of videodiscs for the presentation of conventional linear motion pictures will probably catch on like wildfire. Non-linear interactive applications will make a real contribution to the quality of education but not until instructional development becomes a matter of production, instead of experimentation. (51:10)

Such technological changes can be seen and handled, and are thus easier to accept than the human factors. Mager has some concerns about the nation's future, in light of the energy crisis, inflation, and the national deficit. These problems combined with a more sophisticated technology will create a situation he calls a "crisis of competence" . . . "And as we hire more and more people with less and less entering competence to handle more sophisticated jobs . . . this crisis of competence will become even more severe." (44:20) Essentially business and industry will have to find definite solutions to the national problem of decreasing productivity.

Mager states that the answers are available . . . essentially task analysis and criterion-referenced instruction . . . these are proven techniques. The remaining question is whether or not trainers will put aside tradition and personal preferences and use the tools of instructional design. (44)

A review of traditional training compared to today's situation indicates that

> Now, the trend is away from the programmatic, stand-alone, ad hoc courses and materials. As these programs (usually for a group or class) diminish in number, they are being supplanted by customized

> personnel development processes, in which more focus is on the individual. (8:30)

Convenience coupled with motivation increase the potential for success in training.

> If there's any untapped value in software, it's a potential for individualized learning. Trainers will start to fly once they tap people's natural desire to improve themselves and give them access to a variety of software. It won't be long until many training films will be available in home video cassette formats. (50:37)

## Summary

In conjunction with the review of the literature, a survey instrument compatible with a structured interview format was developed. The literature indicates some specifics on the use of individualized instruction in business but is fragmentary and includes only isolated examples. An overview of its appropriateness and application is lacking. In reviewing the literature, certain questions arose regarding the current use of individualized instruction and its future. These questions have been incorporated into the survey instrument.

## Chapter 3

## SURVEY DESIGN AND APPROACH

As stated earlier, this study describes the general use of individualized instruction by high technology corporations in the San Jose area. The literature search revealed only individual case studies or descriptions of corporate individualized programs, and very few were related to electronics firms. No regional or national survey was found or cited. While not exhaustive in scope, this study intends to show a current or "state of the art" usage of individualized instruction. Companies surveyed included component manufacturing, computers and peripherals, and software sales.

As the literature was reviewed, a number of questions arose concerning media, instructional development, the appropriateness of individualized instruction. These questions, along with questions based on the author's experience, formed the basis for the questionnaire used in the survey.

The questionnaire was developed for use with a structured interview approach. Questions were designed for quick, short, quantitative answers which would provide data convenient for numerical analysis. In order to encourage

cooperation and frankness of response, questions were structured for the respondent's "best estimate". A structured interview format was chosen to increase the accuracy and number of responses, as compared to a mailed questionnaire.

Questions were grouped into the following categories:

1. Uses of individualized instruction.
2. Instructional development techniques.
3. Media and programs.
4. Future plans.

The initial survey instrument was reviewed by Nola Obermire, Director of Obermire Associates, a Sacramento-based consulting firm. Ms. Obermire provided valuable assistance in wording the questions into a flowing interview approach, and with a logical sequence progression. Dr. Roger Addison, of Operants, Inc., (52) reviewed the survey from a data gathering viewpoint. Changes, based on his experience, were incorporated in order to simplify the answers given by the respondent, thereby encouraging participation. Both reviewers anticipated the need to define several terms, including individualized instruction, affective, cognitive and psychomotor domains. During the course of the interviews, the need for such definitions did occur and problems were avoided by providing definitions as the questions arose.

Appendix A contains the survey instrument used.

Firms selected for participation in the survey had the following common characteristics:

- At least one full time person assigned to training and development.
- National headquarters located in the San Jose, California area.
- Employ a minimum of 500 people (ranged from 600 - 11,000 employees).
- A high technology firm (electronics or computer related).
- Training originates at the national headquarters.

Not all firms having these characteristics could be included in the survey due to time limits of the project. Inability to contact the correct individual in a company caused some firms to be excluded and problems of arranging a mutually satisfactory appointment time excluded other firms. Three of the electronics firms contacted have no training program at all. However, all three are presently evaluating the role of training in their companies.

In all, eleven (11) firms were interviewed. Appendix D lists the individuals interviewd, their positions and companies.

The survey instrument worked best with smaller companies and those with younger training and development programs. In attempting to simplify responses, the questionnaire was too simplistic for some training programs and corporate structures. The survey grouped "Management" into one category while several firms had 2 or 3 distinct

levels of management, each receiving markedly different emphasis in training.

Information gathered and published by the San Jose and Santa Clara Chambers of Commerce was used to help identify companies. San Jose Magazine also published listings of local firms along with brief characteristics in its March and April 1979 issues. Discussions with trainers identified several other firms. In addition to the firms interviewed, 20 other firms were tentatively identified as having the prerequisite characteristics. Thus, 33% of the firms having the prerequisite characteristics were surveyed. If the three firms with no training staffs are included, then 43% of the firms were contacted. These firms are listed in Appendix B.

The "San Jose area" used in this study consists of San Jose, Santa Clara, Mountain View, Cupertino, and Sunnyvale street addresses.

An average of four telephone calls was required to contact the correct individual and arrange the interview.

Interviews required 40 to 80 minutes to complete, somewhat longer than anticipated. Thirty-five (35) minutes was the intended time frame. The extended time was due to anecdotes, explanations, and qualifiers offered by the trainer being interviewed.

In several instances, defining "courses" and "modules" could not be done accurately. Uncertainties were decided by mutual agreement or estimates. Indexes of course

titles were not maintained by several companies, which made reliable quantification difficult.

Chapter 4 summarizes the survey results. Comments and qualifying statements are incorporated into Chapter 4 and 5 to provide a more complete description than can be indicated by numbers alone.

## Chapter 4

## SURVEY FINDINGS

"Training" is a term almost as general as "automobile." It creates a general impression and a closer look reveals a wide variety of styles and features, each designed for a different customer. In all, seven different training departments were identified among the 11 companies surveyed. The departments identified were: corporate, sales and marketing, field engineering, software engineering, manufacturing, company policy and orientation, and management development. A single company might have as many as 5 of these departments within its training sphere. In all cases, more than one training department existed.

Eleven "high-technology" companies related to the electronics industry were surveyed. Information from ten of the companies is discussed and quantified here. The eleventh company, Tymshare, a computer time-sharing firm, differs from the rest since it sells a service rather than a manufactured product. Information gathered from the Tymshare interview is summarized in Appendix B.

Because one person at each of the other companies was interviewed, a good overview of one area was obtained. It was not possible to adequately describe the entire

company's training activities. Specifics on the individuals, departments and companies are described in TABLE 1. The training departments are grouped into three categories: (Field engineering, manufacturing, and corporate), also identified in TABLE 1. Each group is discussed separately. General observations and conclusions follow the discussions.

## Field Engineering

Field Engineering seems to be the most visible and well supported group among the departments observed. Field Engineers (F.E.'s, also called computer engineers, customer engineers and service reps) are responsible for diagnosing and repairing malfunctions in equipment owned or leased by a client. F.E.'s work under continuous pressure since they are called only when equipment is not operating. This "downtime" is when equipment is at a stand-still and the customer is losing money. The F.E.'s represent the company and as a result create the company's reputation. A poor service reputation affects business through lost equipment sales and returned lease equipment when a client switches to another manufacturer's product. Properly trained F.E.'s are therefore influential to the financial and future success of their firm.

Each time a new product is introduced, the Field Engineers must be trained in its installation and maintenance. A Field Engineer, new to a company, requires training in the old products as well. Turnover time of a Field Engineer

averages three years. (53) He then goes to work in a similar position for another company. The new company must orient the engineer to the company's policies and procedures, as well as train him on its old and new equipment.

The lecture or "platform" technique remains the primary means of communicating knowledge to the Field Engineers. TABLE 2 summarizes this finding. Several reasons for this approach were indicated. In terms of development costs, lecture is the most inexpensive format. It is, of course, the traditional way of disseminating information and many individuals in management feel it is the best (or only) way to teach. It satisfies the ego also, as the expert is able to pass on his wisdom. In some cases, once a new product is announced, time constraints make the lecture format the most logical means of informing the staff quickly. Individualized modules require extended development time and are more accurate when maintenance records can be reviewed and known problem areas included in the module.

| Company | Lecture | Individualized Instruction | Small Group/ Seminar |
|---|---|---|---|
| A | 98% | 2% | 0% |
| B | 95% | 5% | 0% |
| C | 49% | 49% | 2% |
| D | | mostly | |
| E | mostly | | 0% |
| F | 50% | 50% (lab) | 0% |

TABLE 1: Formats for Presentation of Training Programs to Field Engineers

Supplying training programs in the complex and quickly changing area of electronics requires an active staff.

The cause of correlations among staff size, number of students, size of company are not obvious. There is a greater positive correlation with size of the company and number of staff, than with size of staff and number of students trained. It does follow that the larger, older companies have more products which must be described. TABLE 2 describes this relationship.

| Company | Students Trained in 1978 | Size of Staff | Total Staff | Ratio of Students to Staff |
|---|---|---|---|---|
| A | 18,000 student hours | 8 developers, 10 local & 10 regional instructors | 28 | 643 hours: 1 developer |
| B | 230 students | 2 developers, 5 instructors | 7 | 33 students: 1 |
| C | 700 students | 15 instructor/ developers, 11 management & support | 26 | 27:1 |
| D | 150 students | 2 developer/ instructors | 2 | 75:1 |
| E | 250 students | 22 instructors & support staff & management | 30 | 8:1 |
| F | 300-400 students | 100 total; more management than most companies | 100 | 4:1 |

TABLE 2: Relation of Students to Training Staffs

(All figures are based on "best estimates" of the trainer interviewed.)

| Company | # Employees in Company | # Employees Covered by Field Engineering Training Department | # Receiving training in 1978 | # in Individualized Training in 1978 | Primary Products of Company or Division |
|---|---|---|---|---|---|
| Memorex | 11,000 | 500 | 18,000 student hours | unknown | Computers, Word Processing Equipment, Audio and Video Tape |
| Measurex | 2,000 | 700 | 230 | 230 | Measuring devices |
| Four-Phase | 4,000 | 600 | 700 | 700 | Computer systems for Data Processing |
| Anderson-Jacobson | 600 | 200 | 150 | 150 | Terminals and Modems |
| Amdahl | 3,000 | 370 | 250 | 250 | Large-scale General Purpose Computers |
| Hewlett-Packard Computer Division | 1,700 | 700 | 400 | 400 | Computer Terminals and Peripherals |

TABLE 3: Field Engineering Training Departments

Support staff includes technicians needed to maintain the training equipment, clerical services, and arrangements coordinators. A large company brings 300 to 400 field engineers to the corporate headquarters each year for training. This involves many travel arrangements, in-town transportation, and per-diem expenses. Four-Phase, for example, maintains 14 apartments and a fleet of 24 cars for its trainees. Hewlett-Packard and Memorex have similar support staffs. TABLE 3 provides comparisons of company size and employees trained in 1978.

The training staff assumes it provides the overwhelming majority of the knowledge that the field engineer uses on the job. Negligible knowledge is derived from technical manuals alone. There are always additional sources of information. The median for information learned "on-the-job" from other workers is 15%. (This excepts the O-J-T program which follows basic training in several companies, and refers instead to the knowledgeable field engineer.)

| Company | Courses | O-J-T from other workers | Technical Manuals |
|---|---|---|---|
| A | 90% | 10% | 0 |
| B | 90% | 10% | 0 |
| C | 80-85% | 15-20% | 0 |
| D | 30% | 70% | 0 |
| E | 85% | 15% | 0 |
| F | (cannot be separated) | | |

TABLE 4: Sources of New Job Skills and Knowledge

A common stereotype of a field engineer is that of a figure partly obscured by the components cabinet, an open attache case of tools in the foreground, working miracles on the machine as the office staff watches from a distance. The typical field engineer enjoys the hardware and trouble-shooting aspects of the job, and chose field engineering for this reason. There is, however, a definite trend toward adding awareness and training of interpersonal skills.

In his work, a typical field engineer spends more than 50 per cent of his time on interpersonal skills. (54) In all firms, these skills are taught during the basic training program only, and all advanced course work is strictly equipment oriented. None of these behavioral science topics have been individualized. TABLE 4 summarizes the attention given to interpersonal skills training. Dave Hamilton, of Measurex, points out that a field engineer must deal with all levels of management and develop the client's confidence in the product, despite occasional malfunctions.

| Company | Attention to Interpersonal Skills |
|---|---|
| A | 3 days out of 3 weeks (10%) |
| B | 2 days out of 6 weeks |
| C | None indicated |
| D | Outside workshops are attended at F.E.'s discretion |
| E | Some. More to be definitely added |
| F | 11 days out of 11 weeks (10%) |

TABLE 5: Time Given to Interpersonal Skills During Basic Training of New Field Engineers

Obviously there are common denominators which run through all instructional programs, regardless of the department or company. However, due to the specialization and proprietary nature of most products, there are details unique to each product and company. For this reason, commercial or customized commercial packages are not generally specific enough to be useful for training field engineers. TABLE 6 summarizes the sources of individualized modules and compares them to one corporate training department's courses, in which the behavioral sciences are emphasized.

| Company | In-House Production | Commercial Programs | Customized Commercial |
|---|---|---|---|
| A | 100% | | 0 |
| B | most | In customer relations | 0 |
| C | 100% | | |
| D | 97% (30 courses) | 3% | 0 |
| E | 100% | 1 obsolete | 0 |
| F | 100% of product line | Behavioral science | 1 (Behavioral science) |
| G | 20% | 10% | 70% |

TABLE 6: Sources of Individualized Materials

The work performed by field engineers is well suited to use of performance objectives in the design of the course materials. The job situation is a continual test of an individual's knowledge, since it is a "go/no-go" situation where the equipment either works or doesn't work after servicing. Courses involve much "hands-on" lab practice (the best learning method according to Dale's Cone of

Learning) and testing is performance based.

All six companies use performance objectives when designing courses. Both Memorex and Four-Phase use a task analysis procedure as part of the instructional development plan. This clarifies the desired outcomes and the specific points to be included in instruction.

In all companies, input from a variety of sources was regularly sought in developing course content. None of the training staffs develop material entirely independent of subject matter specialists. Anderson-Jacobson, for example, consults field engineers, product specialists, and engineers in developing a course. Amdahl periodically reviews maintenance records and incident reportings to determine problems which should be added to the course materials and as an informal check on the success of their former students.

## Evaluation of Courses

Five of the six companies also validate or test modules with sample student groups before the course is initiated. All companies have training staff reviews before implementation. This, combined with a thorough development process produces a product judged "successful". Memorex has found developmental testing at its various regional training sites valuable due to differences in staff characteristics and equipment emphasized in different regions.

Formative evaluation is also used frequently in modular development, and also as a means of gradually individualizing a course. Four-Phase is gradually converting components of its lecture format courses to an individualized format as time permits. In one firm's testing, students were disappointed to discover that the remaining modules didn't even exist yet. They had expectations of being able to repair the entire system when they finished the series. Obviously, the trainer's orientation of students to the session remains vital.

The need to validate the lesson on a truly representative target population is also apparent. One lesson at Amdahl seemed thoroughly developed when evaluated by an experienced field engineer. While he enjoyed it, the problems encountered by a group of truly typical students sent the lesson back to the developer for revision and simplification.

The quality of a Heath-kit do-it-yourself project in electronics is being evaluated at Amdahl. A Subject Matter Expert (S.M.E.) found the procedures easy to follow. Now a secretary, naive to the subject, is proceeding through the course for comparison. The question of motivation will still remain unclear. Will she be as motivated as a naive field engineer whose job depends on how well he learns? (54)

Student success in a course is measured in several ways . . . formal and informal. At Hewlett-Packard the field office pays $80 per day for its engineer to attend

the training sessions. If the following job performance is below expectation, the training staff is likely to find out. Four-Phase has one full time person who solicits feedback from field engineers and managers on the quality of the instruction. Written tests serve primarily as a formative evaluation in providing a self-check for the student. Final testing is performance based and most suitably so, since it is identical to the actual job situation. Course content is structured in a learning hierarchy also, with emphasis on mastery learning. Performance check-points in the lab sessions insure that the student is mastering the material. Here again, it is a "go/no-go" situation. The student practices until he is competent.

Amdahl follows up on its basic training success by contacting both the F.E. and his manager after six months. Course critiques by the students give Amdahl and other companies a general idea of their success also. Follow-up evaluation of the training courses is a weakness of most training departments. Once the student returns to his job, there is little feedback about the appropriateness or accuracy of the material. To remain successful, a field engineer must remain knowledgeable. In most companies, F.E.'s are scheduled for training as a regular part of the job. All new hires attend a basic training course which lasts up to eleven weeks, depending on the company.

## Individualized Programs in Field Engineering

Orientation to a new product is handled in different ways. Because it must be introduced quickly to a large number of people, the lecture method is most efficient from the time standpoint. Four-Phase is moving away from the lecture and trying to produce an individualized audio-visual module immediately. Rapid production can be accomplished with a medium like Sound-On-Slide. This may be far more economical than the travel and living expenses involved in bringing several hundred F.E.'s to the corporate headquarters, or even to a regional training facility, to introduce the new product.

Memorex is moving in this direction also, but with a different consideration in mind. Even with seven regional training sites, there is not adequate classroom time available to schedule all the classes needed. Providing individualized lessons to its fifty offices will help reduce that pressure, while still providing competent instruction.

Hewlett-Packard and Memorex are among the early pioneers in electronics development. Each has a number of products which are no longer being manufactured but which continue to perform reliably for many clients. Servicing of these older machines is no longer taught in the courses, but the need for training remains. Because the F.E.'s who need the information are few in number and widely dispersed, individualized lessons are the solution both firms have adopted.

Due to the turn-over of F.E.'s, Subject Matter Experts on the old systems are rare, and both companies use the Sound-On-Slide format to help provide the needed information.

Two different philosophies govern the selection of media for use with individualized lessons. In one, the proper use of an instructional design process will dictate the medium most appropriate for that particular lesson. A different lesson may indicate a different medium more appropriate for that situation. The medium is simply a tool and it is unlikely that one medium will suffice for an entire course or training program. Memorex, for example, is equipping its fifty branch offices with a video playback unit, a carousel projector and cassette recorder, and a filmstrip/audio cassette player. Lessons will be supplied in the most appropriate format.

The other approach is to standardize the media used. This reduces equipment and maintenance costs and decreases confusion about operating procedures by inexperienced people in the branch offices. Four-Phase is standardizing on two media . . . videocassette and Sound-On Slide. Videocassettes are used to convey concepts and principle, while the Sound-On-Slide illustrates assembly techniques, adjustments, and parts locations. Anderson-Jacobson has standardized on the S-O-S system as its primary medium.

3M's Sound-On-Slide system is the only format used by all six training departments. It consists of a 35mm slide surrounded by a circular audio tape and held in a

plastic frame. Thirty seconds of narration provides ample time to describe the visual image. The projector can be used in an individualized mode or converted to wall projection for group use. Revisions are convenient because one slide at a time can be substituted or changed. Hewlett-Packard identifies each slide with a code number to facilitate replacement. Visuals and narration are always in sync, which simplifies use by naive operators in the field.

TABLE 7 summarizes the number of individualized programs and media used by the ten companies surveyed. Numbers are only "best estimates" but do give a clear indication of emphasis. They should not be construed to indicate any particular trends. The interviews suggest that the number of A-V programs and the media used will be quite different for some companies a year from now. Figure 1 illustrates media use in presentation of individualized programs.

Company

| | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| Slide/tape sync | 3 | | | | 1 | | | 3 | 2 | 3 |
| Sound-on-Slide | 3 | 3 | 36 | 2 | 10 | 9 | | 1 | | |
| Filmstrip/audio sync | 3 | | | | | | | | | |
| Audio cassette | | | | 249* | 3 | | | | | |
| Audio with printed text | | 10 | | | | | | | 1 | |
| 16mm film | | 4 | | | | | 4 | | | |
| Video | 6 | 150 | 100 | | 50 | 100 | 20 | 3 | | 20 |
| Computer Assisted Instr. | | | | | | 1 | | | | |
| Trainer/Simulator | | 1 | | | 1 | | | | | 1 |
| Written Programmed Mtls. | 4 | | | 5 | 30 | | 20 | | 5 | 1 |

TABLE 7: Number of Individualized Programs Available by Medium

* Many accompany technical manuals

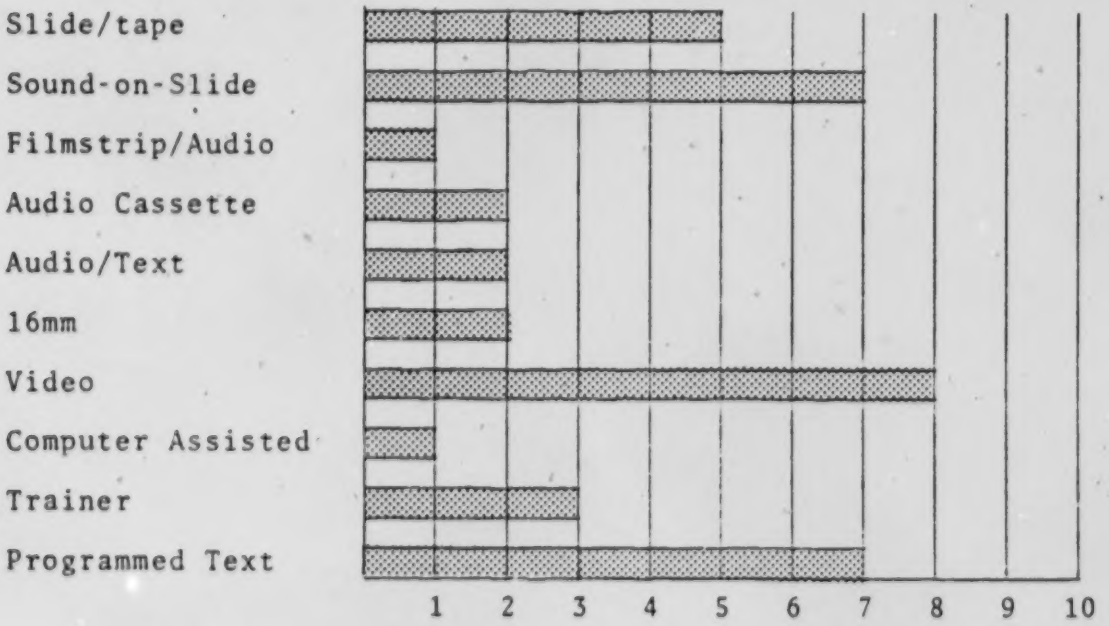


Figure 1: Number of Firms Utilizing Particular Medium for Individualized Instruction

(N = 10)

Revisions of existing lessons seem a general weakness of training programs. For example, one company has a thorough follow-up for one course but no evaluation or feedback on its other ten courses. The basic assumption is that the development process is sufficiently thorough to guarantee success. Jack Keyser of Memorex and Martin Troy of Hewlett-Packard share the same philosophy about revisions. The need exists; however, experience indicates that it is usually due to major product changes. Time limitations direct effort to the development of new lessons, rather than revision. Anderson-Jacobson also revises only when a major product change occurs. Amdahl revises courses informally after each presentation. This, however, is revision of the lecture area of the course. Four-Phase's continual effort at follow-up was mentioned earlier with one full time staff member working on course evaluation. It is the exception, rather than the rule.

## Manufacturing Training

The number of different products, the turnover among field engineers, and the need for competency make field engineering training suitable for individualized instruction. Manufacturing divisions face similar problems of many complex machines, need for high productivity and employee turnover. Formal training is not yet as well established for manufacturing as for field engineering, but it is rapidly developing.

National Semiconductor and Synertek have recently expanded their training programs for manufacturing skills. Kelly Ross at National Semiconductor and Kirby Lindsay at Synertek provided descriptions of their respective training operations.

Synertek produces electronic components for clients on a custom order basis, while National Semiconductor produces a large line of components for general sales. Synertek employs approximately 1,000 people while National Semiconductor employs 8,000 people in Santa Clara County and 25,000 world-wide. The difference in size and age of the companies has ramifications in the scope of the manufacturing training.

Training in production skills is essentially vocational training, where a worker is taught a particular set of skills so he can produce a particular product. It provides training for a worker's present job situation and is not concerned with his future career growth within the company.

A distinct difference between the two companies is the method of measuring success in training. National Semiconductor pays its production workers in hourly categories which are related to the quality and quantity of components produced. Thus, trainees have an ongoing financial compensation for the skill level acquired through training. Synertek has performance testing and feedback on work quality from production supervisors in its wafer

fabrication training program, but does not tie production to hourly wage.

Kirby Lindsay was hired in 1978 to establish a training program for Wafer Fabrication. Inability to find experienced workers and the ongoing need for trained workers led to recognition of the need for in-house training. New employees now receive instruction, company orientation, technical vocabulary, and safety as well as job skills training. Certain production jobs require certification through the training program. Certification remains valid for 3 months or until production procedures change. Certified workers return to the training facility for re-testing every 3 months. At Synertek, line supervisors can refer workers to training for remedial work, and three to four employees are terminated each month because they are unable to pass performance testing after training.

Currently both companies produce all materials for manufacture training. Vocabulary and equipment vary from company to company which prohibits use of commercial programs. The proprietary nature of most manufacturing processes means that commercial programs could not be adapted any easier than total in-house development.

Synertek has heavily individualized its wafer fab program while National Semiconductor primarily uses the classroom approach and is developing individualized modules. Table 8 compares the approaches:

| FORMAT | SYNERTEK | NATIONAL SEMICONDUCTOR |
|---|---|---|
| Lecture | 1 | 4 |
| Small Group | 0 | 4 |
| Individualized | 20 | 2 |

Number of Lessons

TABLE 8: Comparison of Lessons and Presentation Format

The manner in which new manufacturing job skills are acquired differs markedly from that of computer field engineers as indicated by Figure 2:

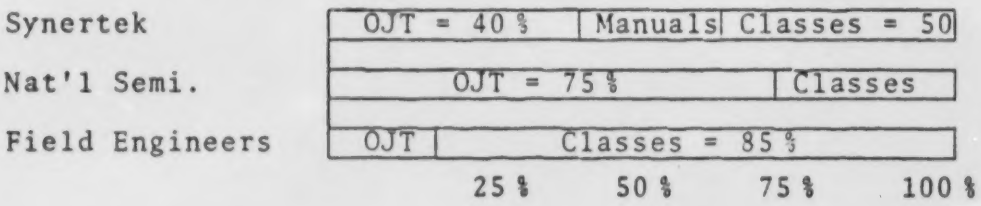


Figure 2: Sources of Job Skills

Due to the sequences involved in production equipment and quality control standards, the use of performance objectives is logical and convenient in instructional development.

Both firms use objectives in designing training and get input from production supervisors and process engineers, as well as training staff.

Good feedback is obtained from Synertek's production supervisors and engineers on the success of the training program. This feedback allows timely revision or updating of lessons. Feedback is also facilitated by trainers, workers and supervisors being located in one facility.

After Synertek's training staff completes and reviews a new lesson, it is submitted to Process Engineering for review. Only after their approval is the lesson implemented. National Semiconductor also validates the program through the appropriate supervisor and also tests it on a sample group before implementation.

All new employees at both companies go through training. In addition to operational skills, both departments provide some training in interpersonal skills for supervisors. National Semiconductor uses video for evaluation and improvement of its instructors' lecture skills. Synertek has begun working with the sales and marketing staff, while National Semiconductor receives informal input from its marketing staff.

Synertek divides each instructional module into separate lessons while each course at National Semiconductor has several modules, each with objectives and post-test. National Semiconductor uses 11 modules, only 1 of which is commercially produced, in its two individualized courses. Synertek has 20 individualized lessons.

The equipment and numbers of mediated programs are included in Table 7.

National Semiconductor is still developing its training plan and intends to make greater use of individualized modules and particularly Sound-On-Slide. Intentions are to acquire the PLATO system of computer-assisted-instruction by mid-1980.

## Corporate Training

In establishing its goals and activities, Corporate Training considers the future growth and operation of the company. It attends to the company's needs and expectations as well as enhancing the individual's career capabilities. Supervisors, administrative support personnel, and several levels of management are included in the target population.

To conduct the company's business successfully, managers need to use both management techniques and interpersonal skills. The management area includes accounting, company procedures, and decision-making techniques, leadership skills, and maximizing staff performance.

Corporate trainers work with ideas, theories, and people, rather than operational skills which produce tangible products, the target. The cognitive and affective domains are stressed over psychomotor skills. Intel groups its courses into orientation, technical subjects, and management categories.

Intel is divided into 4 manufacturing divisions, according to product lines, with Corporate Training providing management courses for all 4 divisions. Each division has its own training staffs for manufacturing, and sales and marketing.

Enrollment in an Intel University course takes precedence over normal job responsibilities. Failure to

attend a class usually puts the employee at the bottom of the waiting list for any future classes of Intel's 16 corporate courses. (55) Half of these courses have been somewhat individualized through use of student workbooks and videotapes. At Rolm, all 13 courses are classroom lecture format.

Tradition accounts for much of the rationale in use of lecturing. As a result of procedural channels, chain-of-command hierarchies, and organizational development charts, many managers are authority figures. They are comfortable with a style of "telling" others what to do, and lecturing feels "natural". Job responsibilities also often make adequate preparation difficult and the lecture is the simplest to present to a group.

General course goals, rather than performance objectives, are used by Intel trainers. This topical or subject matter approach also makes lectures convenient.

Before a new course is offered, a course proposal is developed by a training staff member and submitted to Intel's Management Course Review Board for approval. This group consists of the company president, two vice-presidents, representatives from the four divisions, and representatives from the training staff. The course proposal is evaluated and compared to commercial programs available from outside consultants or training companies.

While the training staff succeeds with some

proposals, the majority (70%) of its individualized courses are obtained by purchasing the rights to a commercial package. Usually, a purchased program is customized to fit Intel's vocabulary and characteristics. Intel has thus decided that the costs of developing a course is usually less efficient than purchasing a comparable course from a reputable training company.

Such an august body gives status to the training courses, although the majority of the group is not knowledgeable in instructional design techniques. This would seem to make evaluation of the course intent and content difficult until it is used in the classroom. Rolm, on the other hand, states all its course objectives in behavioral goals.

Students do complete critique sheets on the success of courses, including the individualized ones. These are usually a type of "happy sheet" and actual written testing, performance testing, or follow-up on the job is not conducted. Rolm also relies largely on feedback from supervisors to evaluate the success of its courses, rather than on written or performance testing which would relate directly to the stated objectives. Management generally has a "gentleman's agreement" about the use of testing, meaning that managers are not to be demeaned nor embarrassed. So, evaluation is not done. At Intel only one division currently uses testing after its courses. This seems to be typical.

Table 7 summarizes and compares media used by Corporate Training with other training departments and companies. The primary difference is Rolm's use of video and slide/tape programs during the lecture format while Intel has many video and Programmed Instruction materials in an individualized format. Rolm has no individualized materials.

Neither firm has made audio-visual equipment available for use at home. At Rolm, the limited amount of equipment prevents check-out to employees for independent study. The strong use of video at Intel with cumbersome and expensive video playback units eliminates the possibility of home use.

At Rolm, over 700 of the 2,000 employees received scheduled training in 1978. This figure includes new employees attending company orientation. At Intel over 75% of the management staff received training in 1978 (none of which was individualized). Over 50% of Intel's employees participated in training courses and for 25% of the staff, these training programs were in an individualized format.

Looking to the future, neither company anticipates acquiring videodisc in the next five years. Intel is investigating the possibilities of C-A-I for use in individualized instruction and may begin implementation in a couple of years.

Wayne Hawley, at Rolm, foresees an increase of individualized lessons for employee development, particularly

for distribution to other company facilities. Juan D'Avilla at Intel anticipates individualized course development in the technical areas. This will accommodate the rapid increases in technical knowledge and provide flexible options for engineers' and managers' crowded schedules. Individualization of management courses will most likely be slow due to the preference of instructors and management for lecture performances.

## Advantages of Individualized Instruction

Individualized modules are popular with students and trainers alike, and the number of individualized programs will grow. All six technical training departments indicated that individualized instruction will increase in per cent of the total training program. Reasons for this are several. Anderson-Jacobson finds that students learn more rapidly and have fewer distractions than in the traditional lecture courses. Memorex sees it as a partial solution to its shortage of available classroom time. All six companies have field engineers located across the country and even overseas, which makes individualized modules a practical means of instruction. This is especially true since the product line is standardized and repair techniques can be standardized.

Dave Hamilton of Measurex summarized several additional advantages. Individualized instruction is more economical in the long run and allows for individuals'

differing rates of learning. (A "new-hire" could be a junior college graduate or someone with 10 years experience at a different company.) It solves problems created by geographic dispersal of employees. Mastery learning is a basic concept since essential job skills are being taught. Individualized instruction also utilizes expensive lab equipment more efficiently since students have greater access to the equipment. By comparison, a course which is fifty per cent lecture and fifty per cent lab seems like a lot of lab time but it also means that the equipment will be idle fifty per cent of the time because all the students will be in the same lecture. In lab, the students must wait to get practice on the machine. One scanning instrument hooked up to a video display and graphic plotter in the Measurex lab costs about $250,000.

Students at Hewlett-Packard can use several of the labs 24 hours a day. This allows some students additional practice in order to strengthen their knowledge while others can move into more advanced topics. Ideally, all students have complete H-P's self-paced orientation course before coming to the corporate school, but in reality, like students everywhere, there are differences in background and preparation. The open lab provides an opportunity for the student to strengthen specific skills.

Hugh Curley of Amdahl points out that by increasing the rate of learning, individualized modules also become more cost-effective. Shorter learning time means less

expenditures for student lodging, per-diem expenses, and instructor time. More students can be taught in the same period of time. Individualized modules are also accepted well by students. Since development of modules requires more time and expense than a lecture course, management must recognize the eventual rewards of the initial investment.

By returning the field engineer to his job more quickly, the company benefits from his additional productivity.

## Independent Use of Individualized Instruction

Attitudes towards independent study of individualized learning materials varies with several considerations governing the existing policies. Jack Keyser of Memorex points out that field engineers are non-exempt employees, paid on an hourly basis. Home study, therefore, may imply working overtime and legally obligate the company to financial compensation. The F.E.'s are also on call and don't wish to interrupt their home life by additional job responsibilities. Travel requirements of the job also make job-related activities at home undesirable.

At Intel and Four-Phase, the video and Sound-On-Slide equipment is not convenient or built for transportation to and from home, so the equipment is not available for checkout. Amdahl does make Sound-On-Slide available but records were not available on home use.

Individualized materials are made available in various ways by other companies. Students at Hewlett-Packard have access to the labs 24 hours a day. Both Measurex and Anderson-Jacobson make audio cassettes and players available for checkout. Most of the tapes used away from the office at Anderson-Jacobson are in the areas of management development and sales training. Tymshare has a unique fringe benefit. All Tymshare employees are issued their own computer terminal and have access to all the training programs through their home telephone via dial-up. They also receive free storage space in the computer memory which encourages greater use and understanding of the computer. Amdahl has Sound-On-Slide units in the field available for home use. Their self-paced training workbooks, of course, can also be taken home. Amdahl is also converting to a ½-inch VHS video cassette which is compatible with many home video players.

## Future Developments in Individualized Instruction

Development and use of individualized modules will continue to grow as all companies plan to add new individualized titles to their training libraries. Greatest growth will be in the technical and manufacturing areas. The turnover of field engineers creates a continual need for instruction on older products which is not covered in basic products training programs. Memorex and Hewlett-Packard are

among the firms developing programs in this area.

Management tends to be more traditional in its view of "proper" training methods. Platform lecturing provides an aura of authority which many people in management find comfortable and satisfying. Time demands on management also make lecture a more comfortable format and courses taught by management are most likely to remain lecture-based.

Many management or "professional development" topics are difficult to individualize because they involve the affective domain and benefit from interaction among the students. Attitude development, aspects of safety, and customer interaction benefit from group participation and interaction. An Amdahl developer estimates that full 50% of a field engineer's job involves the use of interpersonal skills and therefore additional emphasis on those skills is needed and will be incorporated.

Traditionally training departments have enjoyed little prestige or financial support within the corporation. This situation has changed significantly in the electronics industry due to the shortage of experienced personnel. Investment in training staff, facilities, and programs are very visible in the field engineer training programs. Yet, the support is not without accountability and Four-Phase, for example, maintains records to document the cost-effectiveness of the technical training program.

Records of items such as "downtime", reliability of

servicing, frequency of repair and number of referrals for specialists are available at Four-Phase for the time before and after the extensive training program was established. Thus, the training staff and management can evaluate and justify continued support.

From various comments at several companies, it seems that training of field engineers is regarded as the most extensively developed training area. Manufacturing is clearly related to technical training in that it can teach specific job skills. In several companies, manufacturing is beginning to develop a plan for initiation or expansion of training efforts. This, too, is a result of the shortage of experienced workers industry-wide.

As the next probable development in individualized instruction, it seems that computer-assisted instruction is the leading candidate. Currently, Tymshare is using C-A-I and Hewlett-Packard has one program which instructs in the operation of that particular machine. No other companies use it now; five of the remaining nine companies are planning to acquire C-A-I within the next five years.

Both Memorex and National Semiconductor expect to acquire the Plato system within the next year. Both companies would purchase programs initially, send trainers to programming school, and eventually develop their own programs. Memorex sees immediate use of Plato in management training and computer concepts. In its role of assisting instruction, Plato makes use of other media and text materials.

Another company has a sample terminal in each of its branch offices which is no longer marketed. The possibility of using this available equipment for C-A-I is being considered.

Hugh Curley of Amdahl sees C-A-I in the company's future but recent budget commitments to video and Sound-On-Slide defer consideration of C-A-I for a few years.

Four-Phase sees use of the computer as a textbook which can be easily revised and updated. Terminals will be located in each regional office. This approach differs from the traditional concept of student interaction with the computer through multiple choice branching or testing.

Videodisc is the other recent technical development which has received much enthusiastic coverage. It is already being test marketed in several cities for consumer home use. However, only one firm anticipates any possible use of the videodisc within the next five years. Comments ranged from, "I think I've heard of it", to "We are going to use it". Most people have a "wait and see" attitude. Although the low cost of duplicating discs is a widely acknowledged advantage, most trainers have concern about the inability to record one's own programs. This suggests production and editing costs will be high, but how high is unknown. A company with 50 video cassette players and 50 Sound-On-Slide units in the field is likely to wait until the product is proven before approving an additional medium.

Four-Phase is enthusiastic because videodisc will

combine the advantages of videocassette and Sound-On-Slide into one package.

All firms using video are using cassettes rather than reel-to-reel. Only one company has no plans to acquire video. Since Sound-On-Slide is well suited to its technical training, the other training departments surveyed plan greater use of video, or are using it extensively already.

## Chapter 5

## SUMMARY AND OBSERVATIONS

"Earnings, up 297 per cent in the most recent quarter, 'are almost obscene', he quipped." (Leo J. Chamberlain, Vice-president, Rolm) "In fact, Rolm is growing so fast that the company can't hire enough people to get expenses up to projections." (56)

Ample resources and a need for competent workers imply an increase in training programs in the electronics industry. The shortage of experienced electronics workers is widely acknowledged and the turnover rate at some companies is an alarming but quiet problem. According to one story, an engineer can turn into the driveway of a rival company on his way to work and get an immediate 5% raise for switching companies. Companies routinely award up to $300 to an employee for recommending or locating a qualified worker who is actually hired.

In-house training is growing in importance as a result of this shortage of experienced staff.

One measure of the stature of training departments is the quality of the facilities approved by the company. Management's value of training is reflected in its budgetary allocations for training staff, equipment, and facilities.

Amdahl trainers worked (and occasionally argued) with the architects in the design of their current facilities. It is a one-story building, shared with the Personnel Department, set apart from the manufacturing plants. Ability to obtain features such as porcelain chalkboards and room lighting, and specify location of projector stands, remote controls, and electrical outlets, is indication of the trainer's increased stature. Amdahl is currently building an entirely new and larger facility. Hewlett-Packard similarly operates in a facility designed specifically for its training program.

Four-Phase has sophisticated facilities with approximately 25 carrels in addition to the classrooms, offices, and lab areas. Carrels are equipped for either video-playback or Sound-On-Slide and are available to students upon request.

In contrast, another company has added a training department but with lack of space due to growth, the training facilities are crowded into two rooms and are defined with movable partitions. A tight budget at another company dictates that production, development, and implementation duties are combined into one position. The facilities similarly are sparse and do not create the impression that training is important.

In every training department contacted, new employees were given an orientation to the company. In several cases, Personnel provided the "official" orientation

and the training department added to it to aid the employee in acquiring a sense of belonging and purpose.

This early orientation is recognized as pivotal in the new employee's long term view of the company and his place within the company. (57:54-56)

The on-the-job training programs should be considered a highlight of training in electronics, whether in manufacturing or field service. Employees leave basic skills training saturated with classroom and practice knowledge which is sorted and evaluated throughout the O-J-T experience. The need for application to a working situation problem results in greater understanding to the subject matter. A successful O-J-T experience depends upon orientation of the employee's supervisor to insure his cooperation. This aspect of the program has been informal thus far, and deserves greater attention in order to encourage O-J-T success.

The area of field engineer training should continue to grow since new products are continually being marketed. Corporations which lease large amounts of computers and peripherals are beginning to send their own service engineers to the manufacturer's training schools. Repair of equipment by their own employees is often less expensive than a service contract with the manufacturer.

Based on comments, manufacturing training is still in its infancy at Amdahl, Hewlett-Packard, Four-Phase, and National Semiconductor. This is also implied by the current

lack of training at three large companies which face the same manpower shortages. Manufacturing is looking at field engineering training for ideas and successful formats. At several companies, inter-departmental communication among trainers is increasing, to the eventual benefit of all. Considerations of proper areas of influence and responsibility result in mainly informal interchanges.

Manufacturing or production skills are well suited to individualization, since they are primarily psychomotor. The equipment operation procedures and quality control standards facilitate criterion-referenced instruction and competency standards. The continual turnover and promotion of employees and the continual need to train small numbers of employees at a time on a variety of machines makes individualized instruction a good solution to training needs.

Interjection of interpersonal skills into technical training for field engineers will continue to grow. Although currently only a part of the basic training, the need continues and "refresher" courses or seminars would be beneficial. With attention given to the topic ranging from 6 to 88 hours in various companies, the "ideal" emphasis is still evolving.

A more thorough evaluation of course content, and students' success is needed to alleviate inconsistencies in use of an instructional design plan. Compared to the effort in development and implementation, a meager effort is given to evaluation and revision. Certainly there is an

inconsistency at a company in which a production employee can be fired for not having learned enough, yet management people are not asked if they learned anything from the training session. The "happy sheet" and "gentleman's agreement" must yield to some increase in feedback, through testing, observation, or critiques, on the success of human resource development courses.

The need to coordinate growth and activities of training departments is indicated by current efforts in several companies. The stated intent is not to dominate or dictate activities, but to avoid duplication of effort and to share expertise.

Hewlett-Packard's archives of mediated programs is a valuable resource which is made known through published indexes. Most other companies have not gathered together all the various parts of their programs and summary lists of A-V programs frequently do not exist.

It is interesting to note the success of 3M's Sound-On-Slide equipment. One of the main selling points is the ability to revise only one part of the lesson conveniently while maintaining visual and audio synchronization. In practice, the revision aspect is infrequently used. Trainers feel the time is better spent on developing new lessons. An errata sheet or branch manager's O-J-T is judged adequate to correct slight errors. S-O-S revisions usually occur only when major engineering changes are incorporated into the product.

A number of topics for possible further investigation arose during the interviews. These include:

- What training is given to instructors?
- What qualifies a person to become an instructor?
- Relative influence of instructional designers and subject matter experts on the final course package.
- Anticipated use of C-A-I: costs and origins of programs.
- Employee's viewpoint on how they learn their job skills.
- Methods of measuring employee productivity.
- Cost per hour or day for training an employee.
- Methods of evaluating management training and altered performance due to training.

## Summary

1. The need for training is growing and is being recognized by the electronics industry.
2. Feedback, evaluation, and revision are the weakest aspects of instructional design schemes used in the electronics industry.
3. Training of manufacturing skills will increase rapidly and use individualized instruction extensively.

4. Computer-Assisted-Instruction will be the medium of greatest growth over the next five years.
5. Individualized instruction is cost-effective and will increase for training of technical subject matter.
6. Individualized instruction provides an economical and effective solution to the training problems created by geographic dispersal of employees.

# REFERENCES

## REFERENCES


1. Interview with Don Freeman, senior editor. Insgroup, Inc. (Instructional System Group, Inc.) of Huntington Beach, California. April 10, 1979.

2. Pike, Thurston E., Army Training Support Center, Ft. Eustis, Virginia. Recent Results on the Army Training Extension Course Program (ATECP). Research paper presented to American Education Research Association, San Francisco, California. April 20, 1979.

3. Fisher, Kathleen & MacWhinney, Brian. "AV Auto-tutorial Instruction: A Review of Evaluative Research." AV Communication Review, Fall, 1976, 229-261.

4. Flanagan, John C. "Education - How and for What." American Psychologist, July, 1973, 551-556.

5. Buterbaugh, James G., & Fuller, Robert G. "Personalized System of Instruction (PSI): An Alternative." Audio-Visual Instruction, March, 1975.

6. Brown, Lewis, and Harcelroad. A-V Instruction, Fifth Edition. New York: McGraw-Hill, 1977.

7. Mager, Robert F., & Pipe, Peter. Criterion Referenced Instruction: Course Control Documents. Los Altos Hills, California: Mager Associates, 1976, 10-12.

8. Peterfreund, Stanley. "Education in Industry - Today and In the Future." Training and Development Journal, May, 1976.

9. Opdyke, Bob. "Frustrations in the Forest." NSPI Journal, February, 1979.

10. "The Training Package - What's In It For You." Personnel Management. London: Mercury Publications, January, 1976.

11. "Continuing Education - Pharmaceutical." Training, April, 1973.

12. "New Conclusions on Why and How Adults Learn." Training, January, 1979.

13. Becker, Stephen P. "Learning Contracts: Helping Adults Educate Themselves." Training, April, 1978.

14. Ford, J. Patrick. "Now Hear This." Training, February, 1976.

15. Magnin, Michael. "It's Time to Jump off the Individualized Bandwagon." Training, January, 1977, 23-26.

16. Beaulieu, Rod. "In Defense of Tradition." Training Development Journal, October, 1978, 40.

17. Diamond, Robert M. "Let's Keep the Salespeople Home." Audiovisual Instruction, March, 1979.

18. Shahdanian, John, & Walsh, John J. "Self-instruction Saves . . . " Training, January, 1975.

19. Weisgerber, Robert A. "Trends, Issues & Activities in Individualized Learning." Issued by ERIC Clearing house, February, 1972.

20. "Corporate Video." Training, October, 1976.

21. "How Xerox Trains Top Repairmen." Reprint from Business Week, 1976.

22. Di Primo, Tony. "A-V Systems Streamline Bank Training." Training & Development Journal, May 1977.

23. Magnin, Michael. "Sell yourself - and your boss - on the value of individualized instruction." Training, May, 1976.

24. Standke, Linda. "Cassette Tape Libraries." Training, July, 1978.

25. Fynes, William A. "Self-Development for Salespeople." Training, July, 1978.

26. Mathews, Bonnye L. "Training More Employees for Less Money." Training & Development Journal, September, 1977.

27. Russell, Thomas L. "Adult Education is Doing It: Can You?" Audiovisual Instruction, May, 1979.

28. Smith, Judson. "Why and How Smart Trainers are Switching to Micrographics." Training, May, 1978.

29. "Training at Burger Queen Cuts More than Mustard." Training, July, 1976.

30. "Training Pays Off at Coors Container." Training, July, 1976.

31. "Where Less Time is More Training." Training, 1975.

32. "Peacetime Army Uses 11,994 Beseler Cue/See Units to Simplify Complex Training." Reprint from Beseler Limelight: Charles Beseler Co., Florham Park, New Jersey, 07932.

33. "Vornado Uses Multi-Media to Improve Worker Competency and Combat-High Personnel Turnover." Reprint from Beseler Limelight.

34. "Ways to get Extra Mileage out of your A-V Programs." Training, February, 1976.

35. Solsbury, John L., & Harris, Ralph L. "Videocassettes Boost Sales at Lincoln-Mercury." Training & Development Journal, March, 1978.

36. Ruark, Henry C. "A-V News and Reviews." Technical Photography, March, 1979.

37. "Videodisc Fact Sheet." Army Communicative Technology Office, Ft. Eustis, Virginia, 23604, February, 1979.

38. "AV Solves Technical Training Problems in Alaska." Training, February, 1979.

39. Stewart, Stacy. "Try Making Your Training Flexible and Learner-oriented." Training, February, 1979.

40. Smith, Judson. "Training More for Less with Models, Mock-ups, and Simulators." Training, December, 1978.

41. Market analysis by a San Jose area firm. Based on contract awards 1975-1977 (2nd quarter) and President's 1977 budget for training devices and simulators.

42. Wood, Percy. "Change Begets Change." Training & Development Journal, July, 1976.

43. "Competition Provides Incentive for Greatness." Technical Photography, March, 1979.

44. Mager, Robert F. "The Winds of Change." Training & Development Journal, October, 1977.

45. Toffler, Alvin. Future Shock. New York; Random House, 1970.

46. Knowles, Malcolm S. "Gearing Up for the Eighties." Training & Development Journal, July, 1978.

47. Fauley, Franz E. "The Future of Computer-Assisted Instruction." Training, July, 1978.

48. Bagley, Carole A. "So You Want to do CAI?" NSPI Journal, March, 1979.

49. Magnin, Michael. "Training In Japan." Training, January, 1978, 59-62.

50. Carroll, Walt. "Meet the Man Who's 'reviewed' More Than 2,500 Training Flicks." Training, September, 1978.

51. Schneider, Edward W. "Applications of Videodisc Technology to Individualized Instruction." Technical Report #15. Institute for Computer Uses in Education, September, 1975. ERIC ED 158722.

52. Addison, Dr. Roger, Operants, Inc. 78 Paul Drive, San Rafael, California.

53. Keyser, Jack, Education Specialist, Memorex Corp. Interview, May 16, 1979.

54. Curley, Hugh, Training Department, Amdahl Corp. Interview, May 16, 1979.

55. D'Avilla, Juan, Corporate Training, Intel Corp. Interview, May 4, 1979.

56. Chamberlain, Leo J., Vice-President and General Manager of Rolm's Mil-Spec Computer Division. "Silicon Valley's show and tell confirms that the boom continues." San Jose Mercury News, April 29, 1979.

57. "Orientation: Tell Them What They Need to Know." William W. Ezzell, Training & Development Journal, January, 1979.

# APPENDICES

## APPENDIX A

### USE OF INDIVIDUALIZED INSTRUCTION IN CORPORATE TRAINING AND DEVELOPMENT

1. How many courses are given in the following ways?

| in training | | in management development |
|---|---|---|
| _____ | Classroom lecture | _____ |
| _____ | Small group seminar | _____ |
| _____ | Individualized instruction | _____ |
| _____ | Other _____ | _____ |
| _____ | TOTALS _____ | _____ |

2. What fraction of training or development is on-the-job by other workers? _____

3. What fraction of training or development is from written directions or manuals? _____

4. What fraction is from planned instruction? _____

5.

| Do you provide training or development in: | YES/NO | How many units | How many individualized units or modules |
|---|---|---|---|
| a. Company policies/ orientation | _____ | _____ | _____ |
| b. Production skills/ techniques | _____ | _____ | _____ |
| c. Sales and marketing | _____ | _____ | _____ |
| d. Management skills | _____ | _____ | _____ |
| e. Interpersonal skills | _____ | _____ | _____ |
| f. Basic skills (Math, reading, writing) | _____ | _____ | _____ |

6. How many individualized instruction units do you have in the following categories?

   Produced in-house _____

   Commercially prepared units _____

   Commercial packages customized for your firm _____

7. What fraction of commercially prepared materials are selected:

   after preview by training staff _____

   after preview and sample testing _____

   from written brochure/advertisement _____

8. How do you know when an individualized lesson needs revisions?

9. How often are behavioral or performance objectives used in planning individualized lessons?

   ALWAYS USUALLY HALF THE TIME INFREQUENTLY NEVER

10. Who determines the objectives? Department supervisor ____

    Training staff ____

    Outside consultant ____

11. How many individualized modules used the following media?

    Slide/tape sync _____
    Sound-On-Slide _____
    Super-8 films _____
    Audio tape _____
    Written self-paced Programmed materials _____
    Computer-Assisted-Instruction _____
    Beseler Cue/See _____
    Video _____
    Other: _____ _____
    _____ _____

12. Is the lesson tested or validated before use with employees? NO _____ YES _____

    By training staff _____
    By Dept. Manager _____
    By typical worker _____

13. How do you measure successful completion of a lesson?

| | |
|---|---|
| Written test | _____ |
| Performance test | _____ |
| Altered performance on job | _____ |
| Other: _____ | _____ |

14. What are the rewards or motivations for completing an individualized lesson? Money _____ Certificate _____
Written up in newsletter _____
Other: _____
Job requirement: _____

15. Can appropriate equipment be checked out for home use with individualized lessons?

____ YES
a. How many learners use it? _____
b. How many times a month does the average learner check it out? _____

____ NO
a. Has the idea been considered? YES NO
b. If it was considered, what problems prevented its use? _____
_____

16. How many employees are in your firm? _____

17. How many employees received <u>training</u> in 1978? _____

18. How many management personnel received <u>development</u> in 1978? _____

19. How many people took individualized <u>training</u> lessons in 1978? _____

20. How many people took individualized <u>management</u> lessons in 1978? _____

21. How many on training staff? _____

22. Reasons for using individualized instruction:

<u>The Future - Your Program Five Years From Now</u>

1. Do you anticipate acquiring different equipment for use with your individualized instruction materials?
YES _____ NO _____.
If <u>YES</u>, what equipment will increase or be acquired?

What equipment (if any) will decrease in use? _____

2. Do you expect an increase in the use of individualized lessons in your training program? NO _____ YES _____.
If YES, in what areas will it increase? _____

If NO, why not? _____

3. Do you expect an increase in the use of individualized lessons in your management development program?
NO _____ YES _____.
If YES, in what areas will it increase? _____

If NO, why not? _____

4. Have all your individualized lessons been "successful"?
YES _____ NO _____
If NO, did you redesign _____ or reduce individualized instruction? _____.

If NO, what lesson topics weren't successful with an individualized instruction approach? _____

5. Do you expect videodisc to affect your program 5 years from now? NO _____ YES _____
If YES, HOW?

6. Do you expect computer assisted instruction to affect your program five years from now? NO _____ YES _____
HOW?

Area of Training _____ Company _____

## APPENDIX B

Firms in the San Jose area involved in "high-technology" (electronics, computers and related equipment) with over 500 employees.

* National Semiconductor
* Synertek
* Rolm
* Intel
* Memorex
* Four-Phase
Hewlett-Packard
* -Computer Services Division
-Data Systems Division
* Tymshare
* Anderson-Jacobsen
* Amdahl
* Measurex
Spectra Physics
United Technology

IBM
Lockheed-Aerospace & Research
-Research
Fairchild
Information Storage Systems
Siliconix
California Microwave
Advanced Micro Devices
GTE Sylvania
Aertherm Aurex
Applied Technology
** Optimum Systems
Microform Data Systems
Shugart Associates
** American Microsystems
** General Devices

** No training staff

* Firms Interviewed

(Range = 600 to 25,000 employees world-wide
= 500 to 8,000 employees in the San Jose area)

## APPENDIX C

INTERVIEW WITH SONNY BAKER

Training Coordinator, Tymshare Corporation

In the interview, it became clear that Ms. Baker's responsibilities cover a broader range of training programs than the survey could distinguish and describe. Rather than attempting to make generalizations which fit the questionnaire, but would be innacurate, Tymshare's several training programs are summarized separately here.

Tymshare sells and leases computer time and programs to a variety of businesses: tax processing services, medical information, processing of credit card transactions, data and message communication services. Revenues for 1978 were 48% over the $101.2 million achieved in 1977. Corporate growth has been rapid with 1978 revenues three times that of 1974, according to the 1978 Annual Report. Along with this success, the number of employees has increased rapidly also.

There are approximately 3,600 - 4,000 employees at present.

Sonny Baker was recently promoted to coordinate the training activities of several groups. There is much effort

devoted to customer training, since the client must understand the service he has purchased. He must be able to operate the various programs accurately when inputing and using data. Repairs and troubleshooting are taught by Field Services to Tymshare's field engineers. Much attention is also given to professional skills training for the sales and marketing group. This is essential since the company's product is primarily a service, which can't be put directly into a fancy package.

New Sales Representatives and Field Engineers attend a basic products school, then go out in the field for on-the-job training. They return to the corporate headquarters for Advanced Product School or Advanced Sales School. Field Managers return to San Jose once a year for seminars on new products and programs. Members of the training staff also make tours annually to take courses into the field.

Commercially prepared materials have proven successful in sales training. Tymshare tries to hire experienced Sales Representatives but is finding this approach increasingly difficult since experience is much in demand in the San Jose area. Sales Training will be increasingly important as people with less experience or recent college graduates are hired. Customer training and field service training is based on courses developed in-house.

Commercially developed materials are purchased

after preview by the training staff and sample testing. For in-house productions, performance objectives are usually used and are determined by department supervisors and training staff.

New courses are tested before use with classes and after each customer training class, review forms are completed by the participants. Total cost of developing and producing, including printing, one particular new course for customer training will approach $100,000.00 This includes approximately 120 35mm slides, instructor's guide, student workbooks and overhead transparencies. Slides and overhead transparencies are original artwork created by the in-house graphics department.

Salesmen work on a commission basis, which encourages active participation in training sessions. Each Tymshare employee is issued his own personal terminal which allows him access to all CAI programs at home through phone dial-up. Employees also receive data storage space and can use the computer access as they wish.

The biggest emphasis in training expansion will be video use in sales training. Video provides rapid feedback to a sales representative trying to evalute and improve his skills. Use of individualized modules will also increase in courses, as well as the primers designed primarily for customers.

As time permits, some course sequences will be

evaluated with an attempt to simplify and shorten them.

The nature of much of the material does not lend itself to a totally individualized approach. Selling involves the affective domain as much as the cognitive, and role playing and practice of interpersonal skills is stressed. Learning to use a computer program involves numerous small decisions in a variety of situations, which is difficult to cover comprehensively in an individualized module. Ms. Baker also finds that people don't like to learn entirely from a computer. The process becomes routine, boring, and predictable, and students like to have contact with a human instructor. A balance of machine and group interaction is sought in these courses.

| NAME | POSITION | COMPANY | ADDRESS |
|---|---|---|---|
| Sonny Baker | Training Coordinator | Tymshare | 20705 Valley Green Drive<br>Santa Clara, CA |
| Juan D'Avilla | Corporate Training | Intel | 3065 Bowers Avenue<br>Santa Clara, CA |
| Wayne Hawley | Corporate Training | Rolm Corp. | 4900 Old Ironsides Drive<br>Santa Clara, CA |
| Kirby Linsey | Water Fabrication<br>Training Coordinator | Synertek | 3001 Stender Way<br>Santa Clara, CA |
| Kelly Ross | Training, Manufacturing | National<br>Semiconductor | 2900 Semiconductor Drive<br>Santa Clara, CA |
| Bob Aldred | Director, Technical<br>Training | Four-Phase | 10700 N. De Anza Blvd.<br>Cupertino, CA |
| Al Filardo | Training Coordinator | Four-Phase | (Same as preceding) |
| Hugh Curley | Technical Training | Amdahl Corp. | 1250 E. Arques Avenue<br>Sunnyvale, CA |
| Dave Hamilton | Director, Training | Measurex | One Results Way,<br>Cupertino, CA |
| Roland Helstrom | Training and Development<br>Coordinator | Anderson-<br>Jacobsen, Inc. | 521 Charcot Avenue<br>San Jose, CA |
| Troy Martin | Instructional Developer,<br>Computer Systems Group | Hewlett-Packard<br>Computer Ser-<br>vices Division | 19310 Pruneridge,<br>Cupertino, CA |
| Jack Keyser | Instructional Developer,<br>Technical Education | Memorex | 1200 Memorex Drive<br>Santa Clara, CA |

APPENDIX D: Companies Interviewed